The MINING CONGRESS JOURNAL

Volume 15 JULY, 1930 No. 7

ANTHRACITE NUMBER

Featuring the Operations of The Lehigh Navigation Coal Company

Early History of Anthracite
Its Contribution to Prosperity
The Industry and Legislation
Accident Prevention and Industrial Relations
Transporting and Marketing Anthracite
Research and New Markets
Service to the Consumer

Other Features

The Present and Future Application of Mechanized Loading
Calumet & Arizona's Sulphuric Acid Plant
History and Development of the Denn Mine
Legislative Review

Contributors

E. W. Parker, Eli T. Conner, Noah H. Swayne, J. C. Haddock, C. K. Gloman, Alan C. Dodson, A. K. Morris, H. S. Gilbertson, R. V. Frost, C. A. Connell, A. J. Johnson, J. B. Warriner, L. A. LeVan, W. S. Rausch, A. G. Frank, R. E. Hobart, J. S. Miller, S. E. Thorne, F. R. Edwards, T. D. Thomas, H. J. Seitzinger, F. S. Riordan, R. H. Kistler, A. C. Neumuller, G. B. Southward, N. E. Jacks, C. E. Bronson, J. A. Wilcox.

CONVENTION PROCEEDINGS NUMBER

After the Show

Picture three thousand coal men treking back to mine and mill after the American Mining Congress Convention. New ideas in mine mechanization, maintenance, transportation fill their minds—ideas that they are anxious to apply to the operation of their own properties.

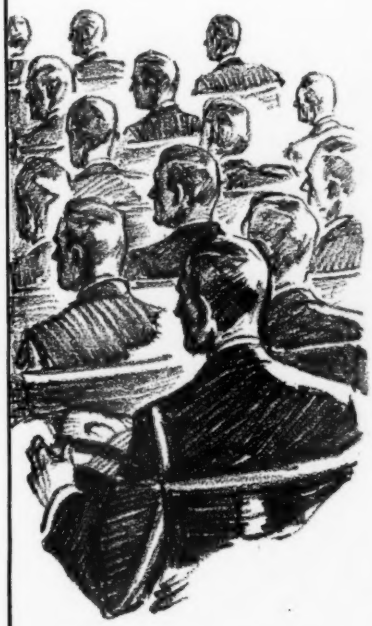
Other thousands unable to go to Cincinnati—Eagerly they await the report of what transpired there. They know that what was said, seen and done there vitally affects their economic future.

Here, a prime market waiting for you—a sales opportunity that comes not often. Here, too, a way to reach that market—every single man of it—profitably.

July 21st, The Mining Congress Journal will publish an extra "Convention Proceedings" issue, reporting in full all of the 39 papers given at the 7th Annual Convention of Practical Coal Operating Men, together with the complete official convention report.

An all coal circulation of 12,235 copies is guaranteed to saturate the industry. Every man who attended the convention will receive a copy. Every important executive in every known coal operation will receive a copy—whether he went to Cincinnati or not.

No publication in the coal industry can compare with it for reader interest or advertising coverage in any way, shape or form. Make your reservation now for advertising space in the July 21st issue.



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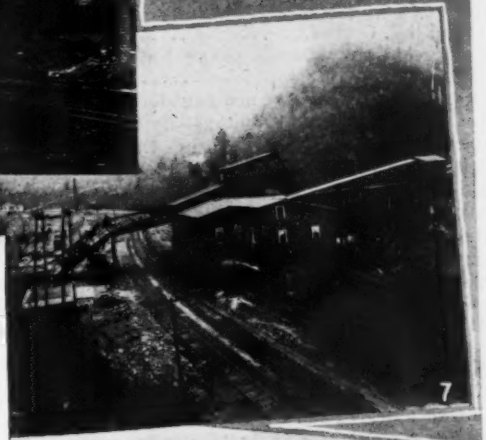
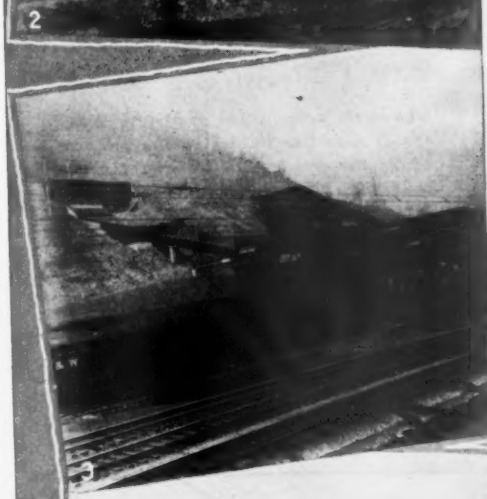
7 More Menzies Installations



The seven plants illustrated use the Menzies Hydro-Separator method of coal washing and separating.

1. Price Hill Coal Co. Price Hill, West Va. 1 Hydro — 50 tons nut per hour.
2. Algoma Coal Co. Algoma, West Va. 2 Hydros—100 tons nut and egg per hour.
3. Upland Coal & Coke Co. Elkhorn, West Va. 2 Hydros—100 tons nut and pea per hour.
4. Page Coal & Coke Co. Pageton, West Va. 4 Hydros—200 tons nut and egg per hour.
5. Pond Creek Coal Co. Bartley, West Va. 1 Hydro — 50 tons nut and egg per hour.
6. Crozer Coal & Coke Co. Crozer, West Va. 2 Hydros—100 tons nut and pea per hour.
7. C. H. Mead Coal Co. Beckley, West Va. 2 Hydros—100 tons nut and egg per hour.



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The MINING CONGRESS JOURNAL

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Practical Operating Men's Department

COAL

[Due to the cooperation of Mr. Newell G. Alford, Associate Editor, in the preparation of the articles on the operations of the Lehigh Navigation Coal Company, which appear in this issue, the Coal Section of the Practical Operating Men's Department is omitted]

METAL

Calumet & Arizona Mining Company's Sulphuric Acid Plant

History and Development of the Denn Mine

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Roebling "Blue Center" Steel Wire Rope

Men and material must travel in safety; the flow of coal to the loading booms must be uninterrupted—*and the responsibility rests on the hoisting rope.*

With wires fabricated from a superior grade of steel made in our own furnaces, and drawn in our mills according to the best manufacturing methods, Roebling "Blue Center" Steel Wire Rope meets the demands of the most severe strains, abrasions and sudden pulls of the strenuous hoisting operations in the most modern mines.

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Sons Company
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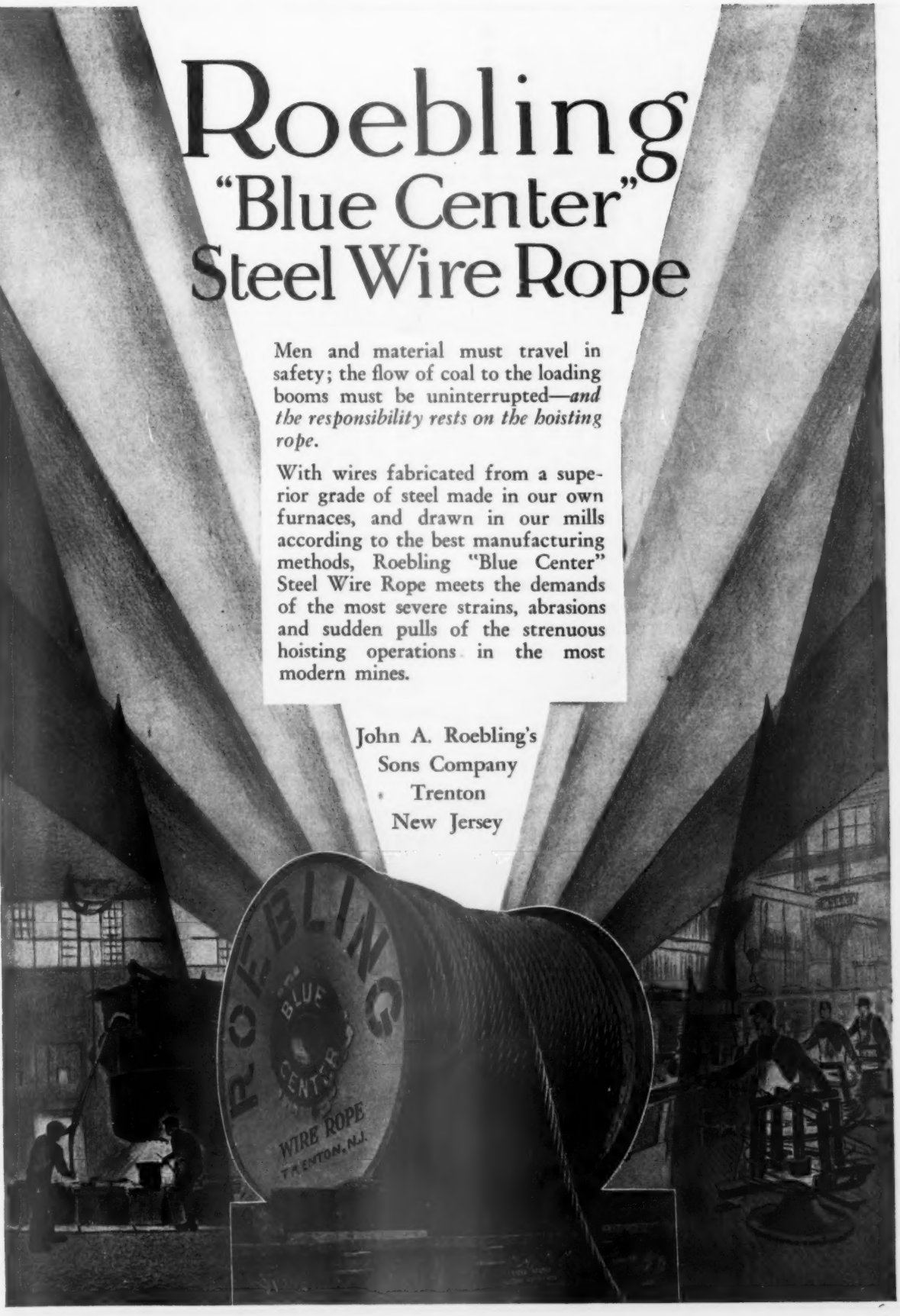

Hulburt Products:

Mine Car Grease
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HULBURT OIL & GREASE COMPANY
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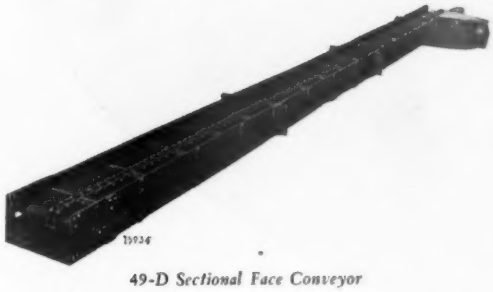
Warehouses throughout the coal fields

Specialists in Coal Mine Lubrication

47-A Sectional Room or Entry Conveyor

Jeffrey Sectional Room Conveyor discharging into Jeffrey Sectional Conveyor on entry for carriage to cars.

Cut Cost of Coal at the Tipple



49-D Sectional Face Conveyor

49-E Sectional Face Conveyor

HANDLING cost between face and tipple adds its chunk of cost, subtracts its portion of profit.

But Jeffrey Sectional Conveyors—47A—57A—49E—49D—will help materially in keeping down this expense—in lowering cost of coal at the tipple.

47A, 100 tons capacity per hour—57A, 30 tons per hour are Sectional Room and Entry Conveyors. 49E and 49D are for use across the face. In a typical set up, the 49E is parallel with the face and coal is shoveled into it. It discharges into a 47A, which conveys the coal out of the room into cars.

Both are light, strong, easy to extend with intermediate sections. 47A, the room or entry conveyor has a maximum length of 300 feet. 49E, the face conveyor will extend to 80 feet.

Save laying track—Work well with mechanical loaders, etc. 47A is reversible and has an automatic takeup. The reversible feature permits carrying in timbers and other materials as well as taking coal out.

Both are flexible—rolling bottom—with or against grades does not handicap.

Send for Jeffrey Catalog No. 425-A.

The Jeffrey Manufacturing Company

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JEFFREY COAL MINE EQUIPMENT

More World Record Crushers

TWO 60-inch Allis-Chalmers Superior McCully gyratory crushers were built for the Chile Exploration Company of Chuquicamata, Chile, in 1926. These were, and still are, World Record Crushers in size, weight and capacity and are of all steel construction.

The crushers have given such satisfactory service, that two similar machines were ordered and are now being built for a large Nitrate Corporation for operation in Chile, South America.

In addition to the four all steel crushers, Allis-Chalmers has built two sixty-inch Superior McCully crushers of iron construction which are used for crushing limestone in this country.

All of these crushers are built with the proven features of Allis-Chalmers Superior McCully design giving large capacity, low maintenance and long life.

Allis-Chalmers builds all the principal machinery, including electrical equipment, for cement, crushing, screening, washing, and mining and metallurgical plants. Before you enlarge your old plant or build a new one it will pay you to call in an Allis-Chalmers engineer.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

Jeffrey "Arcshear" Drills Close to Bottom

when Coal is Top Cut and Sheared

Skinny: Well, you got that drill down to the bottom all right, but how the heck can you git it up again? That thing's too heavy to lift.

Bill: Don't have to lift it; just turn this hand-wheel an' up she comes. Swing the arm out an' it will reach away over to the rib, an' with the arm an' turntable you can shove it out an' in the center if you want to, an' you can drill right flat on the bottom, or right flat against the roof.

Skinny: That sure will make easy shootin'; a couple of sticks ought to fetch her.

Bill: You bet, an' it don't bust up the coal neither; it makes big lumps. That new engineer is comin' around to see her in a few minutes; what's his name, now?

Skinny: Wood.

Bill: Used to be a conductor on the electric line, didn't he?

Skinny: No, that's impossible—Wood is a non-conductor.

Bill: Think yer smart, don't yer?

Skinny: I ain't as smart as he is; he is sure one wise guy. He's a reg'lar engineer, he is. He an' I took a run up to Niagary Falls durin' the shut-down, an' we was standin' watchin' the falls, an' I said, "I wonder just how much water goes over them falls every hour," an' he says "Now Skinny, if you wuz a engineer like me, you would know; why, I can tell you to a quart just how much water goes over them falls at any time." Well, I fell fer it an' ast him how much did, an' he said "Two pints to each quart."

Write for complete data on the Jeffrey Arcshear Machine.

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JEFFREY COAL MINE EQUIPMENT

Miles of Rock Tunnels in Lehigh Mines Driven by Myers-Whaley Machines

Rock tunnels in the Lehigh Navigation Coal Company's Nesquahoning Mine. Miles of such tunnels were driven by Myers-Whaley Shoveling Machines.

Drills in place in a Lehigh mine rock tunnel face being prepared for shooting. After the blast, mucking will be speedily accomplished by Myers-Whaley machines.

EARLY mining in the upper levels of the Lehigh Mammoth and Primrose veins was done largely by means of slopes and gangways driven in the veins. Later, as the mining extended to lower levels and the main haulage ways became more difficult and expensive to maintain, primary haulage ways were driven in rock where the thin veins underlie.

Literally, miles of these rock tunnels in Lehigh mines have been driven by Myers-Whaley Shoveling Machines which here have proven their mine-worthiness, their speed, efficiency and economy of operation. Myers-Whaley Machines are successfully used for tunnel mucking, coal loading, rock loading, entry driving and grading.

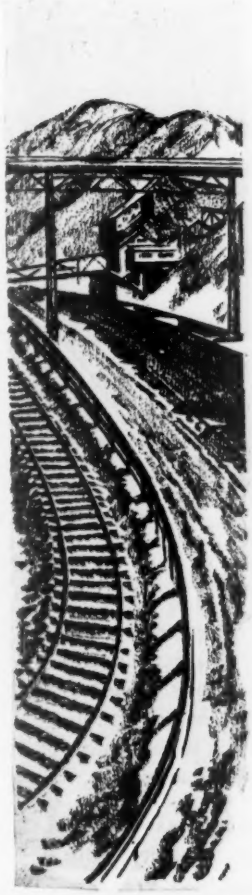
Myers-Whaley Shovels are used in anthracite mining for cleaning up caved areas and fallen gangway, loading out silt preparatory to pulling pillars and loading coal in pulling pillars.

Anthracite Companies Using Myers-Whaley Shovels:

The Lehigh Navigation Coal Co.
The Philadelphia & Reading Coal & Iron Co.
The Pittston Coal Co.
The Lehigh Valley Coal Co.
The West End Coal Co.
The Glen Alden Coal Co.

MYERS-WHALEY CO.

INC. 1908
KNOXVILLE, TENN., U. S. A.

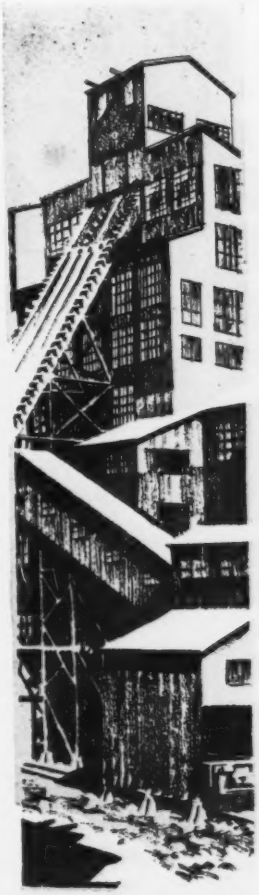


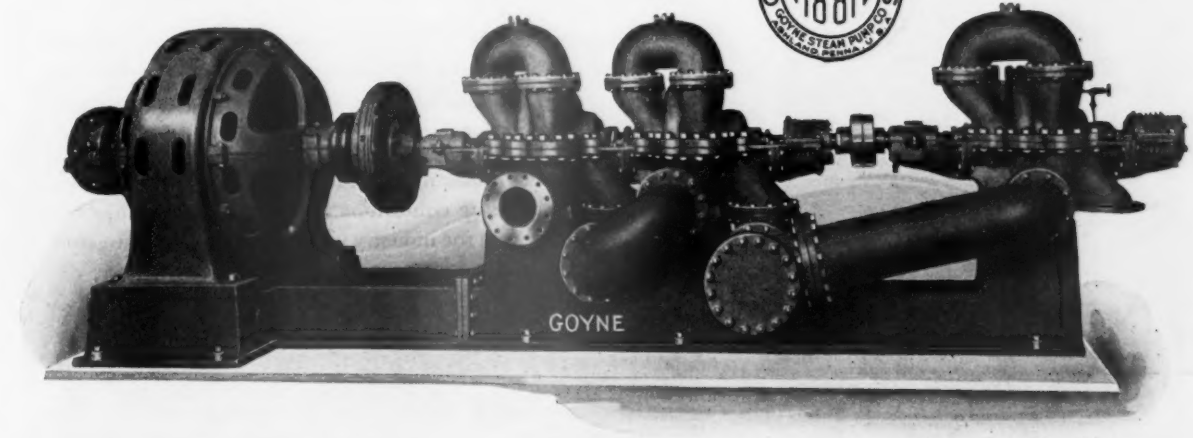
Still Another Installation won on Sheer Merit!

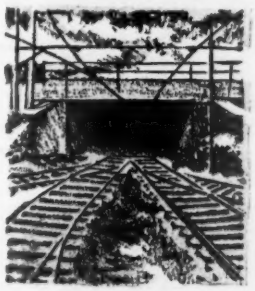
SINCE 1881 Goyne Pumps have served the Coal Mining Industry. In both Anthracite and Bituminous fields their rugged durability and sure dependability is known. On sheer merit they have won and held their high place in the esteem of practical coal operating men.

Among those who recognize Goyne quality are Lehigh Navigation Coal Company Engineers who have placed frequent orders for Goyne Centrifugal Pumps to meet exacting duties in their mines.

Complete installations of Centrifugal Pumps with Automatic Systems for their control and operation, also made in their entirety by Goyne, are available to meet your special requirements.

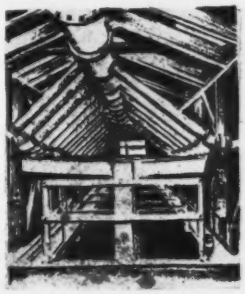






The GOYNE Steam Pump Co.

ASHLAND, PA.



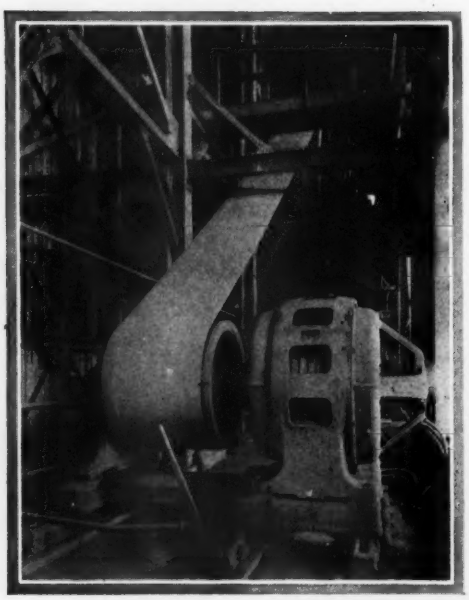
Serving A PIONEER *in Anthracite Mining*

ELECTRIC motors—the driving power of modern mines—are extensively utilized in the production systems of the Lehigh Navigation Coal Company, a pioneer in electrification in anthracite mining. Powering the hoists, pumps, compressors, breakers, locomotives and other equipment throughout the mines of this progressive operator, Westinghouse Motors help keep production moving swiftly, surely—economically.

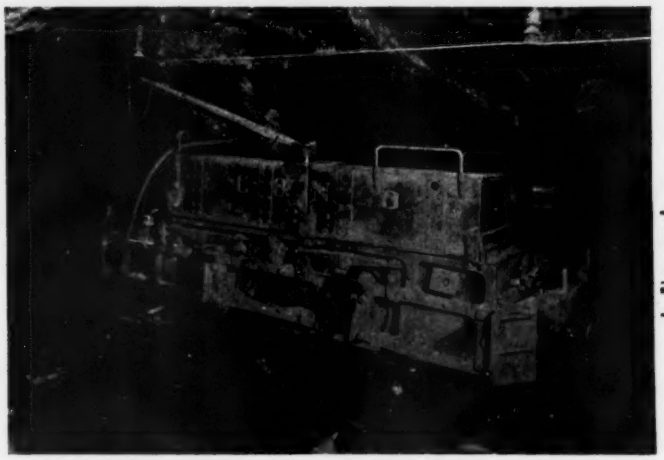
There is more than horsepower in a Westinghouse-powered mining installation. Many years' experience and close contact with coal mining operations have enabled Westinghouse engineers to design motors and control that are specially fitted to the job and the severe requirements of the service.

Dual-Treated Windings, Directed Ventilation, Mica and Micarta Insulation, and Sealed Sleeve Bearings are some of the features of these mining motors that assure long life with economical and dependable performance.

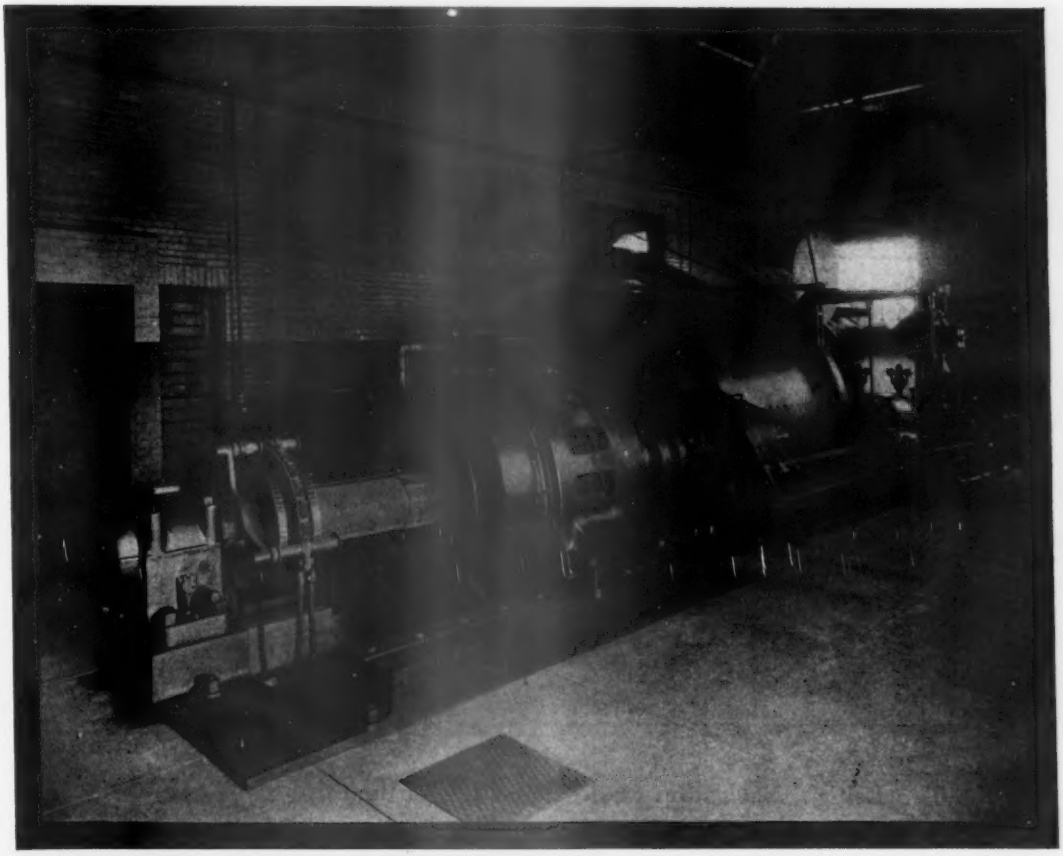
Westinghouse coal mining engineers, with their thorough knowledge of operating conditions are cooperating with many producers throughout the industry in effecting production economies. Their services are at your disposal upon request.



Driving a Lansford breaker—a Westinghouse 500-hp. Induction Motor.

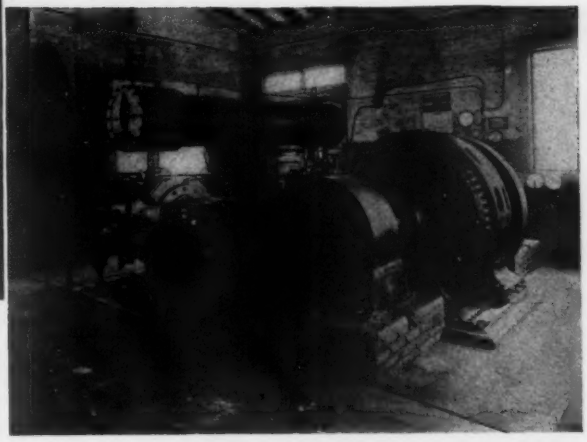


Ten-ton Baldwin-Westinghouse Storage Battery Locomotive in the Nesquehoning mine.



Vulcan Iron Works hoist at No. 14 shaft powered by a 1200-hp. Westinghouse Motor. One of the largest hoists in anthracite mining.

At the No. 6 Lansford Colliery, two Westinghouse-powered Cameron Pumps.



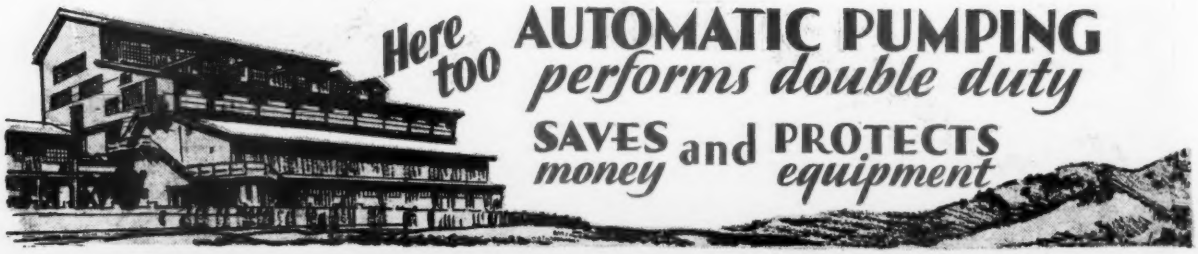
Keeping up the air pressure with a Bury compressor, powered by a Westinghouse 375-hp. Synchronous Motor.

Service, prompt and efficient, by a coast-to-coast chain of well-equipped shops

Westinghouse

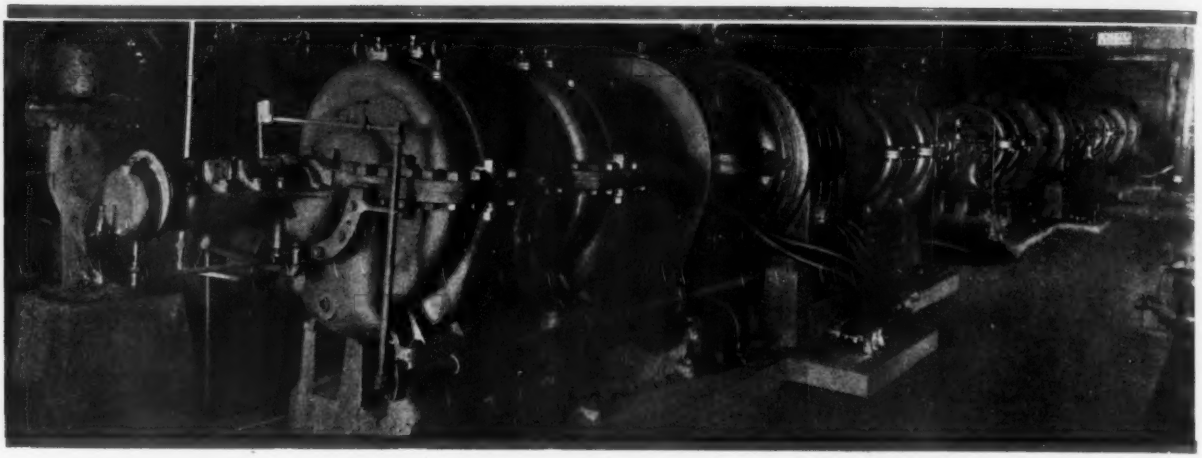
T 31418

TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.



Here too AUTOMATIC PUMPING *performs double duty*

SAVES *money* and PROTECTS *equipment*



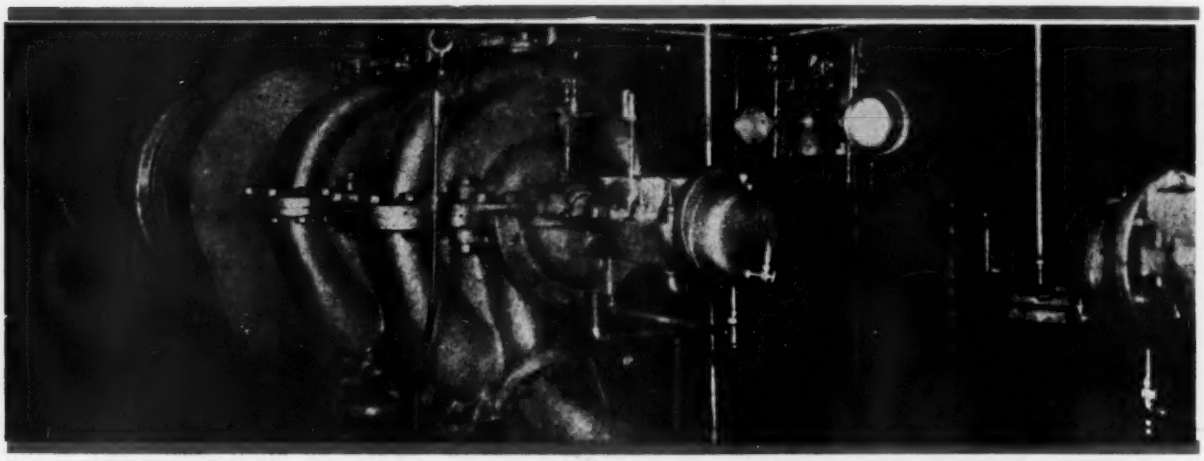
UPPER photo shows three eight-stage pumps installed at Greenwood Colliery, Lehigh Navigation Coal Co., Lansford, Pa. Each pump is rated at 2,000 G.P.M., 800 ft. head, 650 H.P. This station is equipped with HAZLETON Automatic Control.

The Lehigh Navigation Coal Co. was one of the early users of HAZLETON Automatic Control Equipment. Their first installation was made in 1923.

Today practically every important pumping station in the various mines of this company is being controlled and protected by HAZLETON equipment.

LOWER photo shows some of the protective devices installed at another mine of this progressive Anthracite Producing Company.

See our catalog in the Keystone Metal Quarry and Coal Mining Catalogs.



BARRETT, HAENTJENS & CO.

PITTSBURGH, PA. BIRMINGHAM, ALA. ST. LOUIS, MO. HOUGHTON, MICH.

HAZLETON, PENNA.

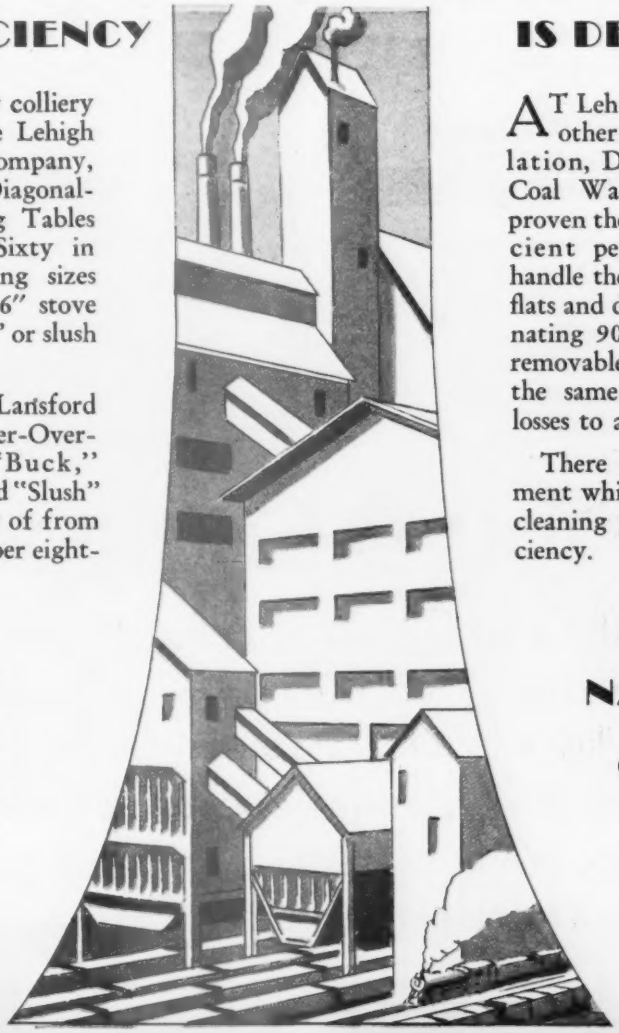
WHERE EFFICIENCY IS DEMANDED

IN practically every colliery or breaker of the Lehigh Navigation Coal Company, Deister-Overstrom Diagonal-Deck Coal Washing Tables are in operation. Sixty in all, they are treating sizes ranging from 2 7/16" stove coal to No. 4 "Buck" or slush 1/16" to 0.

At the Lehigh Lansford Colliery thirty Deister-Overstrom tables on "Buck," "Rice," "Barley," and "Slush" sizes have a capacity of from 1,300 to 1,350 tons per eight-hour day.

AT Lehigh, as in many another big colliery installation, Deister-Overstrom Coal Washing Tables have proven their capacity for efficient performance. They handle the coarser sizes, even flats and down to dust, eliminating 90% or more of the removable impurities; and at the same time reduce coal losses to a minimum.

There is no other equipment which will do the same cleaning job with equal efficiency.



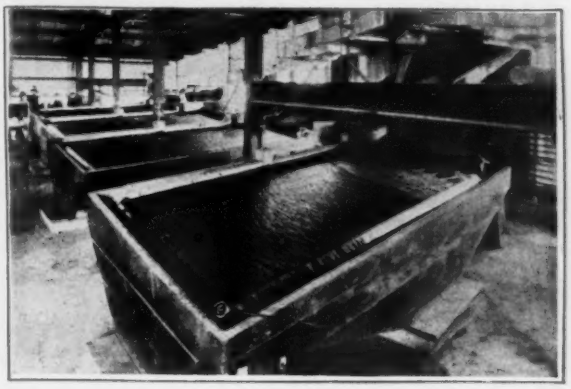
The latest addition to the Concenco line is the Concenco Flat Picker. Equipped with 2½ H.P. Concenco short center drive this machine is unsurpassed for a clean separation of flats from cubical fractured coal. It has shown a 50-ton hour capacity on nut coal removing ½" flats.

CONCENCO PRODUCTS

LEHIGH NAVIGATION COAL COMPANY

USES CONCENCO EQUIPMENT

CONCENCO PRODUCTS



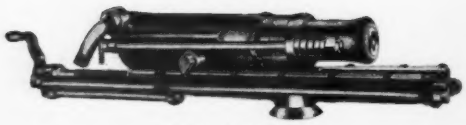
Manufacturers of
DEISTER AND DEISTER-OVERSTROM ORE CONCENTRATING AND COAL WASHING TABLES

LEAHY NO-BLIND VIBRATING SCREENS
CONCENCO FLAT PICKER

The DEISTER CONCENTRATOR COMPANY

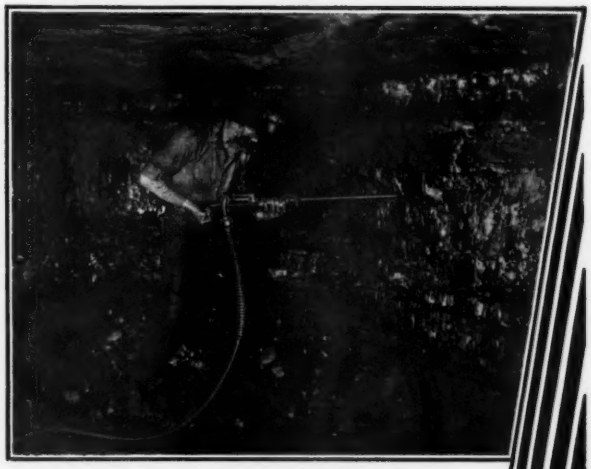
Incorporated 1906
901-937 GLASGOW AVENUE
FT. WAYNE, INDIANA

ANTHRACITE OFFICE
NESQUEHONING, PA.
NEW YORK OFFICE AND FOREIGN SALES DEPARTMENT
104 PEARL STREET, NEW YORK CITY
CABLE ADDRESS:
Retsied



Full Line of Drifting Drills

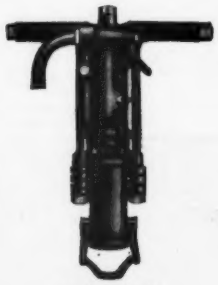
LO-3 Line Oiler



Are You Equipped?

We offer a full line of rock drills for your shafts, adits and other rock work, as well as auger drills and utility drills for taking out coal in the anthracite and other fields where blasting is the mining practice. We have a Sales Branch near you, let us have a representative call on you.

Auger Drill



Medium Weight Utility Drill

Light Weight Utility Drill

GARDNER-DENVER COMPANY

QUINCY, ILL. DENVER, COLO.

SALES OFFICES THROUGHOUT THE WORLD

GARDNER-DENVER

Built *for 150 tons capacity*— Tested *to 180—190!*

ONLY the Link-Belt Simon-Carves Coal Washing System would or could have guaranteed so large a capacity as 150 tons per hour from a single-unit washer, as was done at the above installation.

This is the new Link-Belt Simon-Carves installation at the New River & Pocahontas Consolidated Coal Co. In the test of this plant not only was the expected tonnage of 150 tons handled, but even 180 to 190 tons of 4"x1" coal were efficiently cleaned, ash content being reduced to well below 5 per cent, with refuse containing less than 1 per cent float coal, on washing gravity. This feature of large capacity in a single unit is just one of several outstanding reasons for this system's efficiency and economy. Due to the elimination of back suction, and to the air cushioning which secures unhindered stratification between pulsations, all sizes can be cleaned in the washer compartment simultaneously.

Mining men faced with coal preparation problems should secure full details of the Link-Belt Simon-Carves Coal Washing System. Write for Bulletin 1042.

3933

LINK-BELT COMPANY
Complete Equipment for the Handling, Preparation and Washing of Coal

CHICAGO 300 W. Pershing Road

LINK-BELT

Simon-Carves Coal Washeries

BLINDFOLDED

Choice of coal for industrial purposes calls for a most thorough and careful analysis of every factor pertaining to conditions and equipment which enters into the problem of combustion.

If you feel blindfolded, a little uncertain, as you face the problem of selecting coal for your own plant, a survey made without obligation by a trained Lehigh Navigation Coal Company man, will help you chart an intelligent and a wise purchasing plan.

Old Company's Anthracite, when burned under suitable conditions, has invariably made an enviable record for economy, in steam generation cost during its more than a century of use. Our expert will be able to tell you how to make it deliver maximum returns per dollar.

LEHIGH NAVIGATION COAL COMPANY
Philadelphia

OLD COMPANY'S
LEHIGH ANTHRACITE
Produced by the Lehigh Navigation Coal Company

OLD COMPANY'S LEHIGH

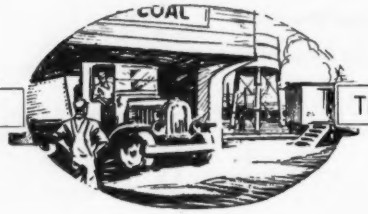
IMAGINE—

A TRAIN FROM NEW YORK TO DENVER

One quarter of a million railroad cars are necessary to supply the yearly demand for D&H Anthracite. This is equivalent to a train extending from New York to Denver, Col. Now, over 50% of D&H Anthracite, the cream of the Pennsylvania deposits, is cleaned by the Chance sand flotation method. Soon 100% of this superior Anthracite will be cleaned by the sand flotation process. D&H Anthracite must pass five tests and a visual inspection before it is allowed to go to market. Enormous tonnage, modern plants and up-to-date methods insure a market product of exceptional merit.

THE HUDSON COAL COMPANY
SCRANTON, PENNA.
G. B. FILLMORE, GENERAL SALES AGENT
H. H. SHAVER, Assistant General Sales Agent
C. D. WINTER, Sales Agent

FOR BETTER BUSINESS

PRACTICAL SUGGESTIONS FOR  THE PROGRESSIVE COAL MERCHANT

IT'S HARDER TO RESELL A DISSATISFIED CUSTOMER THAN TO SELL A NEW ONE

YOU can sell your best customer the best coal you can buy, but if his furnace is full of dust and dirt or the drafts badly adjusted or the flue half stopped up, he will blame the coal and you'll lose him as a customer.

* * *

And, as every coal dealer knows, it's harder to resell a dissatisfied customer than to sell a new one.

* * *

Cleaning and servicing your customers' furnaces need not be an expensive charge on your business. Most home owners will pay a reasonable sum to have their heating plants cleaned and adjusted during the summer months.

* * *

Train one of your men to do this work. Then call up a few of your customers each morning on the telephone and ask if you can send your service man.

* * *

You'll be surprised how many will be willing to pay a fair charge for such a service. And you'll be surprised how much business will result from it.

* * *

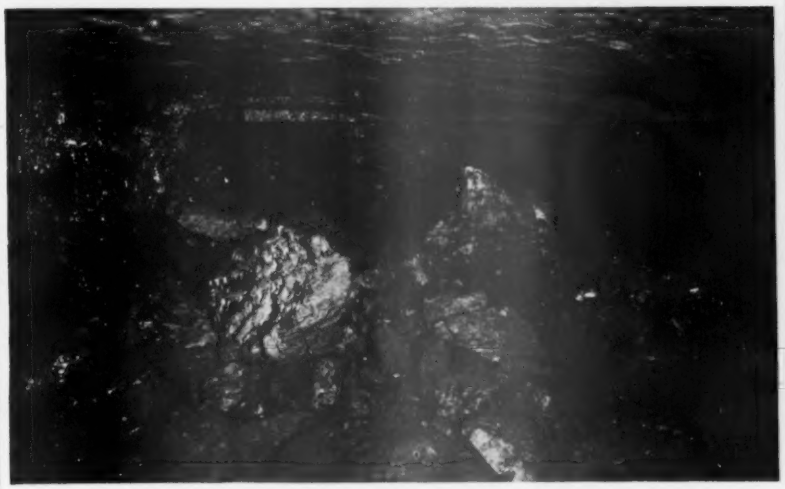
This is the second of a series of articles on coal merchandising which will appear from time to time in this publication. These articles will refer specifically to the successful promotion plans of leading retailers.

We are in position to supply you with attractive mailing folders and envelope stuffers featuring your furnace cleaning service. These will be imprinted with your firm name, address and telephone number.

THE DELAWARE, LACKAWANNA & WESTERN COAL COMPANY

Executive Offices: 120 Broadway, New York City

"Mined by Glen Alden"



A SIMPLIFIED LIST OF MODERN PERMISSIBLES

Only 8 years ago (1922) Hercules listed 37 permissibles to meet the individual and general blasting demands of the coal mining industry. Among these were brands which could be ranked with the best available at that time for any particular condition.

Today, as a result of a development program started in 1923, we offer a list of 9 modern permissibles which cover an even greater range more completely and effectively than did the 37 powders replaced.

This remarkable simplification means that the coal mining industry need choose from only 9 permissibles, each representing a distinct advance over the 37 older types in efficiency or economy, or both.

This is an outstanding example of Hercules' untiring research and exhaustive study of field conditions to produce greater explosives values and to make the selection of explosives easier. You can select the proper permissible for your coal from the list at the right. Check the coupon-list for further information.

HERCULES POWDER COMPANY
(INCORPORATED)

Wilmington Delaware

ALLENTOWN, PA.
BIRMINGHAM
BUFFALO
CHICAGO
DENVER
DULUTH
HAZLETON, PA.
HUNTINGTON, W. VA.
JOPLIN, MO.
LOS ANGELES
NEW YORK CITY
NORRISTOWN, PA.
PITTSBURG, KAN.
PITTSBURGH, PA.
POTTSVILLE, PA.
ST. LOUIS
SALT LAKE CITY
SAN FRANCISCO
WILKES-BARRE
WILMINGTON, DEL.

The Permissible For Your Coal Is In This List

☐**HERCOAL-F:** The new type lump producer. A very high cartridge count permissible (about 500)* with black powder action.

☐**HERCOAL-D:** This Hercoal lies between F and C in count (about 450),* and like them is a black powder action, lump producer.

☐**HERCOAL-C:** Another black powder action, lump producing permissible. Lower count (about 400),* and stronger per cartridge than Hercoal-F.

● ● ●

☐**RED H F-L. F.:** Slow and strong with a cartridge count of about 356.* A lump producer.

☐**RED H D-L. F.:** Slow and strong. Cartridge count around 316*. Another lump producer.

☐**RED H C-L. F.:** Slow and strong. About 276* count and a lump producer.

☐**RED H B-L. F.:** A fast, dense, strong permissible of about 280* count with a smashing action.

● ● ●

☐**COLLIER C-L. F.:** Fast and strong but with higher count (about 320)* than Red H B-L. F.

☐**HERCOGEL:** Dense and strong. Suitable for wet work. Count about 190.*

*NOTE: Cartridge counts refer to the number of 1¼" by 8" cartridges in 100 lbs. of explosives

● ● ●

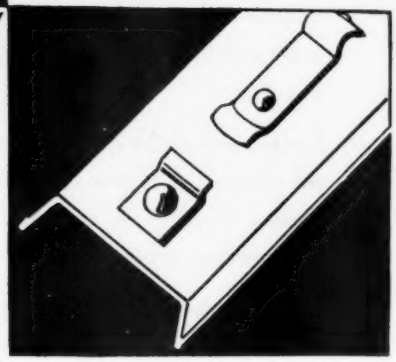
HERCULES POWDER COMPANY
934 King Street, Wilmington, Delaware

Gentlemen: Please send me pamphlets describing the Permissible explosives checked.

Name.....
Company.....
Street.....
P. O.....

B-8

Real Track!



THE RETURN TRACK in a large bituminous mine in Southeastern Ohio is pictured above. Here they selected Carnegie Copper Steel Mine Ties, section M-20, for use under 40 pound rail. M-20 is only one of the large variety of Carnegie Copper Steel Mine Ties available. There is a light grooved tie for room work only $1\frac{1}{16}''$ in height, weighing $2\frac{1}{2}$ pounds per foot. There is a heavy channel tie for the main haul, $2\frac{1}{4}''$ high and weighing 9 pounds per foot. Whatever your need, there is a suitable Carnegie Copper Steel Mine Tie. A number of styles of clips and fastenings are also offered to meet your individual preferences.

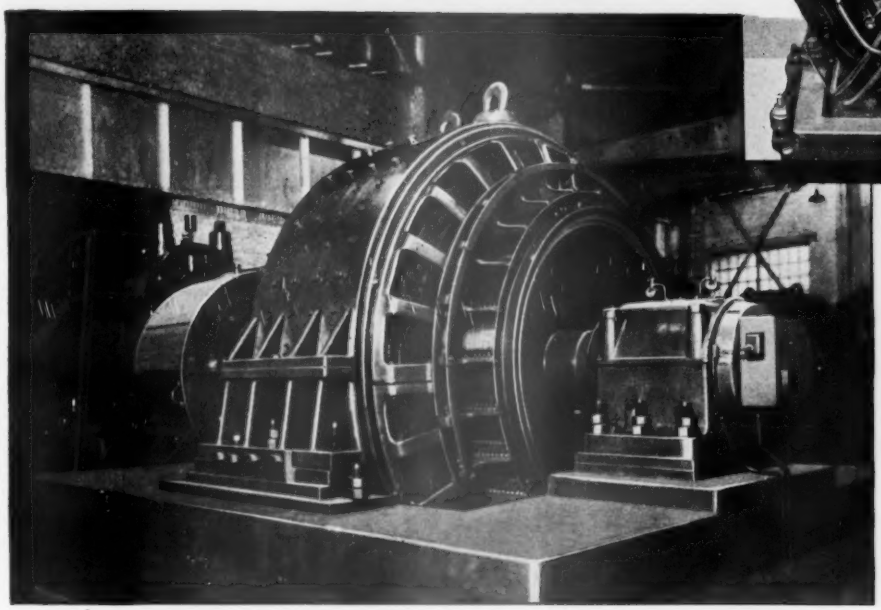
Carnegie Copper Steel Mine Ties are easily and quickly laid. They are economical. They are rust resisting. They provide the foundation for a trouble-free track, true to gauge. Catalogue on request.

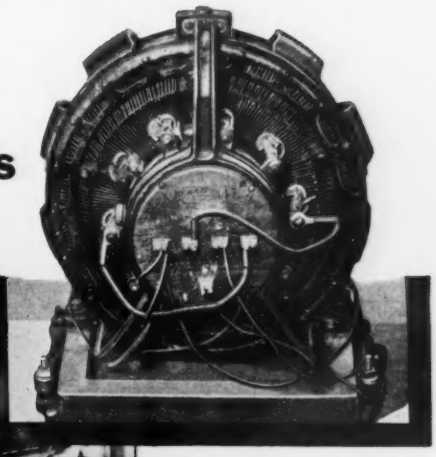
CARNEGIE STEEL COMPANY - PITTSBURGH, PA.

Subsidiary of United States Steel Corporation 79

CARNEGIE
COPPER STEEL MINE TIES

stepping up industrial loads





A 3 K. W., 250-volt Waddell-Entz generator built many years ago.

■

Direct-current reversing steel-mill motor, 7000 H. P., 700-volt, 50 to 120 R. P. M. used to drive a 40-inch blooming mill.

"LIGHT UP the candle of industry," wrote Benjamin Franklin. Little did he dream that some of his scientific discoveries would play such an important part in industry's progress.

Even a hundred years after Franklin, electricity — as far as industry is concerned — was still in the pioneer stage. The heavy loads of today were unknown when the 3 K. W., 250-volt Waddell-Entz generator was built. Steel mills and other industrial loads were driven by steam and water.

Now electrical power carries the heavy loads of industry. "Cut out waste," is the cry. "Reduce maintenance costs to a minimum." With this warning — out goes inefficient machinery. In comes Gargantuan equipment like the 7000 H. P. direct-current reversing steel-mill motor, used to drive a 40-inch blooming mill. Uninterrupted production is assured.

National Pyramid Brushes played a vital part in bringing about this revolutionary progress. The first carbon brush solved a perplexing problem of commutation and, like the Waddell-Entz generator, made a place for itself in the industrial world. But it was not patterned for modern industry. Like the early electrical designs it had to undergo great changes to meet the demands of heavier loads, higher speeds, stricter standards of commutation, lower maintenance cost and dependability.

Many of these changes were made possible through scientific research carried on in the thoroughly equipped Research Laboratories of National Carbon Co., Inc. Constant research and steady progress in manufacturing methods have established the position of leadership which National Pyramid Brushes have held from the start.

Systematic inspection and maintenance of brushes, commutator and brush holders insure longer brush life, more satisfactory performance and greater machine efficiency.

To avoid expensive shut-downs, anticipate your requirements for replacement brushes.

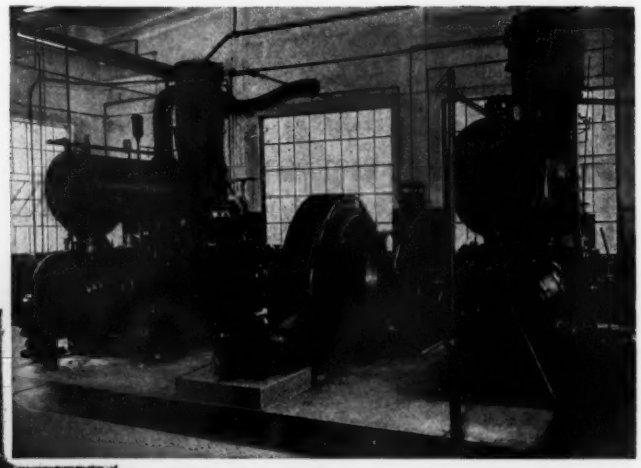
NATIONAL CARBON COMPANY, INC.

Unit of Union Carbide UCC *and Carbon Corporation*

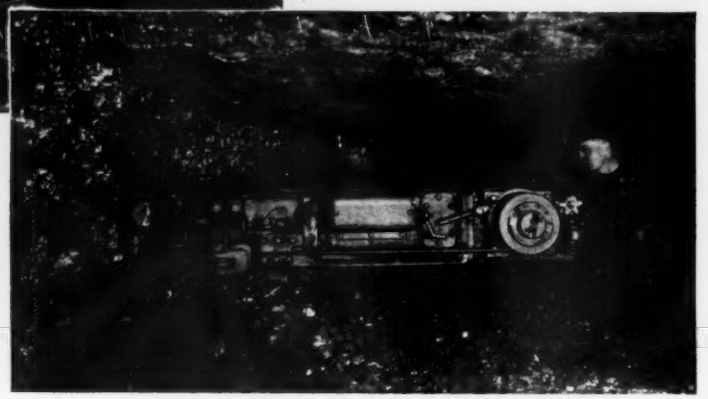
Carbon Sales Division — SILVER STRAND CABLE TRADE MARK REGISTERED — Cleveland, Ohio

Branch Offices and Factories

New York Pittsburgh Chicago Birmingham San Francisco



Right: Sullivan Twin Angle Compound Compressor at work for the Lehigh Coal and Navigation Company. Below: Sullivan Rock Drill putting in a hole.



Right: Sullivan Ironclad Coal Cutter at work.

8 Production Problems mastered with Sullivan Epuipment

1. **Lower cost compressed air power** is supplied the mine by Sullivan Balanced Angle Compressors. Balanced design eliminates vibration, and saves power, upkeep, and floor space. Balanced Angle Compressors are adapted to belt drive, or to direct connection to motor, or oil engine. Capacities 287 to 5900 cubic feet.

Sullivan Compressors are also available in single stage belted and direct connected stationary types, and in portable and mine car models.

2. **Prospecting with Sullivan Core Drills** determines quickly and economically the thickness and extent of the veins and the presence of partings or faults.

3. **For Drilling Rock or Coal** in boring shot holes, taking down top or lifting bottom, there is a Sullivan Drill exactly suited. Sullivan Drills are light, and easy to handle, though powerful.

4. **Good Drill Steel** is made and resharpened quickly, exactly to gauge, on Sullivan All Hammer Drill Sharpeners.

5. **Coal Cutting.** For 45 years Sullivan Engineering has been devoted to making coal mining safer and more efficient. Sullivan coal cutters for undercutting, overcutting, and shearing are constantly a step ahead in modern design and construction.

6. **Perfect Coal Cutter Bits** are made rapidly on Sullivan Cutter Bit Sharpeners; enabling coal cutters to work at maximum efficiency.

7. **Coal Loading.** Scraper Loading with Sullivan Portable Hoists increases output 50 percent per man over the old methods in many conditions. This method is adapted to both longwall and room and pillar mining, with little disturbance of present mining systems, and is particularly economical in low coal.

Data on the Sullivan Rock Mucker Loading slide furnished on request.

8. **Car Pulling** is done quickly and conveniently with Sullivan Small Electric Hoists. 345-lb. models will pull 100,000-lb. trains on level track.

S U L TRADE L MARK I V A N

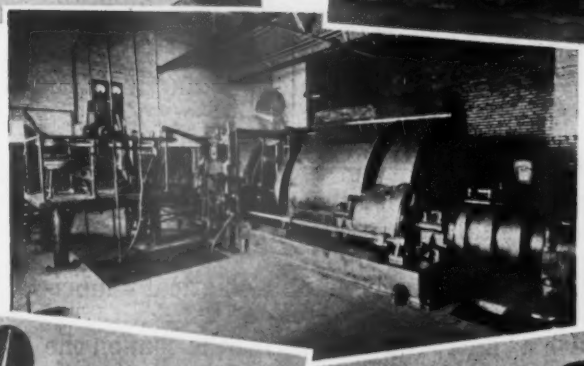
SULLIVAN MACHINERY COMPANY
808 WRIGLEY BLDG., CHICAGO, U. S. A.

Offices in all principal cities of the world

VULCAN

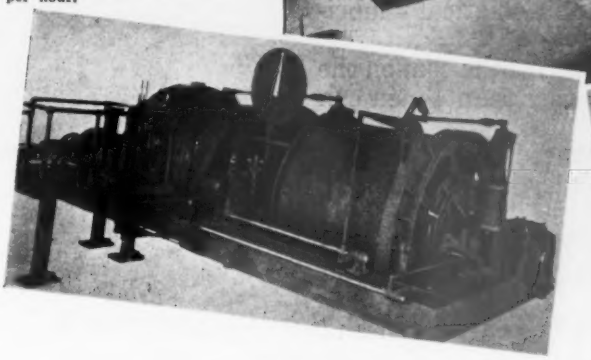
5½ ton storage battery locomotive, furnished for the Cranberry Creek Coal Co., a subsidiary of the Lehigh Navigation Coal Co.

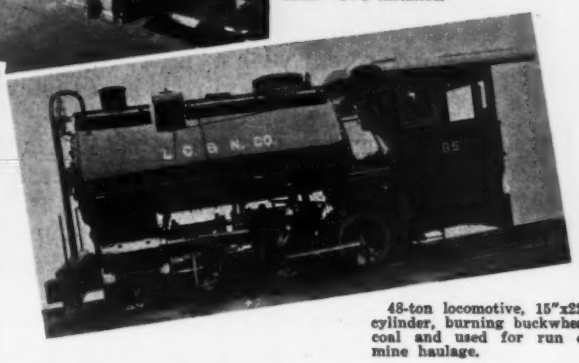
80-ton steam locomotive, 19" x 24" cylinder. 4' 8½" gauge. Burns buckwheat coal and used for heavy rock dump haulage.



1,200 H.P. electric hoist, No. 14 Shaft, Tamaqua. Drum dia., 9'; rope speed, 1,872 F.P.M.; rope dia., 1½"; weight of cage, 11,000 lbs.; and weight of loaded car, 11,500 lbs. Capacity, 80 cars per hour.

1,200 H.P. electric hoist at No. 4 Shaft, Lansford, Pa. Drum dia., 9'; rope speed, 1,872 F.P.M.; rope dia., 1½"; weight of cage, 11,000 lbs. Capacity, 71 cars per hour. Two installed.





48-ton locomotive, 15"x22" cylinder, burning buckwheat coal and used for run of mine haulage.

at LEHIGH

For many years the Vulcan Iron Works has been supplying the Lehigh Navigation Coal Company with an increasing volume of widely varied mechanical equipment—keeping pace at all times with the advances brought about by substitution of electric power for steam—the use of steel instead of cast iron, and the more general introduction of labor-saving appliances.

The same advanced engineering practice, high-grade materials and careful workmanship that have enabled us to meet the exacting requirements of the Lehigh Navigation Coal Company have also enabled us during the same period to extend our business throughout the mining fields of almost the entire world. Wherever coal and ore are mined, Vulcan hoists, locomotives and other equipment will be found, giving superior service and satisfaction.

Correspondence invited regarding any problem involving coal handling, coal preparation or mine ventilation.

VULCAN IRON WORKS

WILKES-BARRE, PENNA.

Eickhoff

Electrically Driven 7.5 H.P. Ball Frame Shakers have proved a mechanical and therefore a mining success in a large number of Anthracite Operations.

Specially adapted in design, size and price to Chamber and Pillar Work in Anthracite Mines

Outstanding Features:

1. A **trough** and **trough connection** that will stand a length of *300 to 400 ft.* without bending or breaking.
2. A **drive gear** that is quickly set up and moved about and which eliminates the necessity of a concrete foundation and of taking rock for extra height in coal as low as 24".
3. A **drive gear** that is totally enclosed and protected against the intrusion of coal dust.
4. A **drive gear** which is internally and automatically lubricated.
5. A **drive gear** with a "kick" that will throw the coal on the level and over local rolls at a faster rate than 4 men can shovel.
6. A **drive gear** with the correctly balanced motion to protect the electric motor from excessive load fluctuations as caused by too sharp a "kick."
7. A **driving connection** that is properly guided and transforms the shaking action of the gear into a smooth and steady motion of the chute.
8. A **provision** that will eliminate buckling on uneven and rolling floor.
9. A **support** that will keep the trough low on the floor, aligned and protected from sliding friction and that will be quickly set up and moved about.
10. A sturdy and well designed **Swivel Trough** that will take the conveyor into corners, crosscuts and pillars and that will enable the conveyor to follow the pillars even if they are out of line.

Eickhoff **Troughs**, totally enclosed ball and roller bearing equipped Drive Gears, Side Drive Connection, Roller Guide Frames, Drive Jacks, Ball Frames and Swivel Troughs are built to embody the above features and make up a unit complete in every detail. They eliminate the work spent for keeping insufficiently equipped conveyors in working condition.

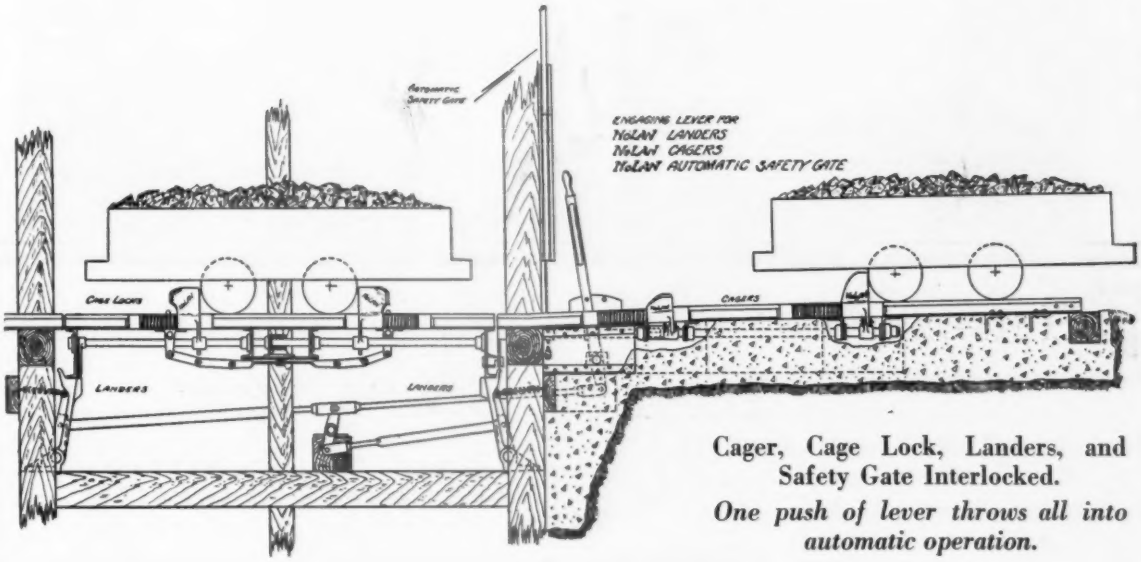
Eickhoff Bros. 116 Adams Avenue, Scranton, Pa.

ROTARY DUMPS
CRADLE DUMPS
CAR HAULS
CAR RETARDERS
AUTOMATIC
GATES
AUTOMATIC
SWITCHES

1910 PATENT 1930
NOLAN
MINE CAR CONTROL DEVICES

CAGERS
CAGE LOCKS
CAGE LANDERS
DUMP FEEDERS
MANUEL CAR
STOPS
KNUCKLE
SAFETIES

— Automatic Caging-Intermediate Levels —



Cager, Cage Lock, Landers, and Safety Gate Interlocked.
One push of lever throws all into automatic operation.

A complete unit for safe rapid caging at intermediate levels.

Automatic cagers, cage locks and approved safety gates and an improved type landing chair all placed into or out of operative position by the motion of the lander control lever.

CAGERS—Designed for rapid, safe car control.

CAGE LOCKS—Receive cars from either side of shaft.

SAFETY GATES—Improved type, giving full protection.

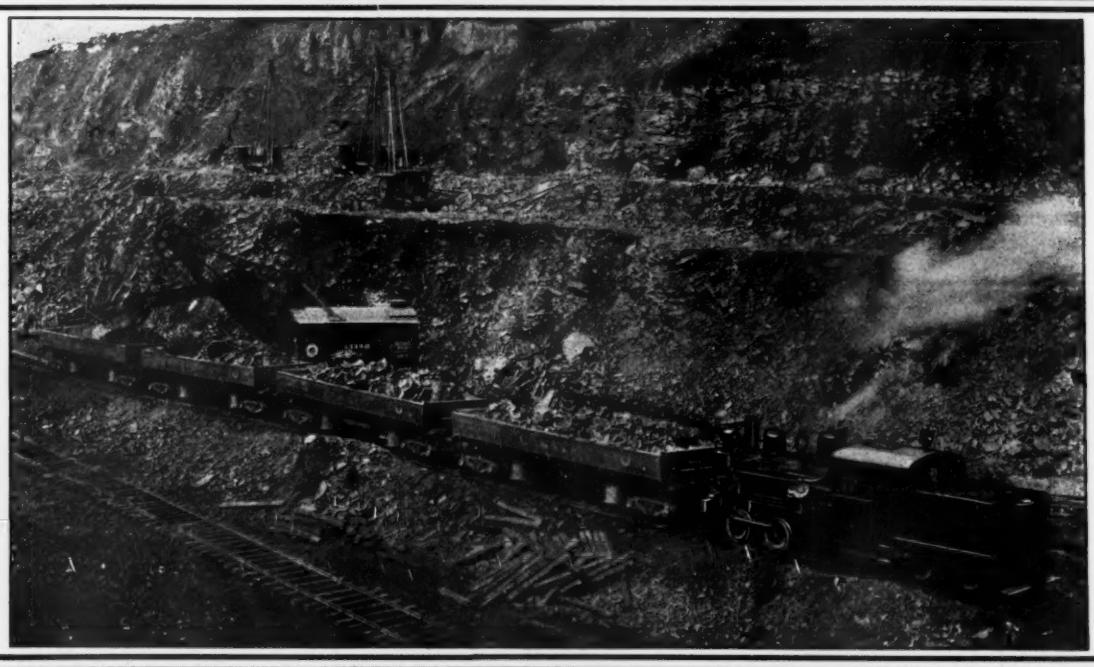
LANDING CHAIRS—Heavy steel chairs suitable to any cage.

A FEW OF THE USERS OF "NOLAN" CAR CONTROL DEVICES:

Philadelphia & Reading Coal & Iron Co.
Susquehanna Collieries Co.
Repplier Coal Co.
Pittston Coal Co.
Pine Hill Coal Co.
Mill Creek Coal Co.
Lehigh Valley Coal Co.
Colonial Colliery Co.
Alliance Coal Mining Co.
Hazle-Brook Coal Co.
Jeddo-Highland Coal & Coke Co.
Lehigh Navigation Coal Co.

Write for Full Particulars

THE MINING SAFETY DEVICE COMPANY
BOWERSTON, OHIO



7 HEISLERS used by Lehigh Navigation Coal Company—hauling *above their guarantee rating*

IF you visit the stripping operations of the Lehigh Navigation Coal Company, you'll see how they are "cashing in" on the HEISLER's greater hauling power.

You'll see HEISLERS that are *consistently* doing better than their guarantee to haul 30% more than a rod engine of the same weight. *In some cases the* HEISLERS *are hauling 70% to 100% heavier loads.*

The HEISLER under the shovel at Cranberry Creek operation of the Lehigh Navigation Coal Company. Note the HEISLER with its two cars of overburden, and the rod engine with one car.

Besides hauling more, the Heisler cuts costs

Track maintenance is lower. The HEISLER's weight is evenly balanced, and the driving power is equally distributed to every wheel. Track costs are lower; lighter rails can be used, and fewer ties; easier on dumps.

Less fuel is used. Because of the HEISLER's more efficient piston speed, getting better combustion, many operators report 30% to 40% less fuel cost per ton-mile.

Engine upkeep cost is lower. Because of its sturdy, simple and flexible construction and smoother flow of power the HEISLER operates well within its capacity on hauls that are a severe struggle for a rod engine.

It will be a pleasure for us to help you estimate the savings that you can reasonably expect of a HEISLER. Write us.

HEISLER LOCOMOTIVE WORKS
Erie, Pa.

HEISLER
GEARED LOCOMOTIVE
STEAM, GAS-ELECTRIC, OIL-ELECTRIC

195

After all is said and done

Repeat orders determine the success or failure of any mechanical device.

In every case, where Hydrotators have been installed, *repeat orders have followed—*

This illustration shows a Hydrotator installation at the Tamaqua Colliery of the Lehigh Navigation Coal Company. It is cleaning a mixture of Rice and Barley Coal—capacity—fifty tons per hour. Notice the double deck shaker for separating the two sizes after cleaning.

LIST OF INSTALLATIONS

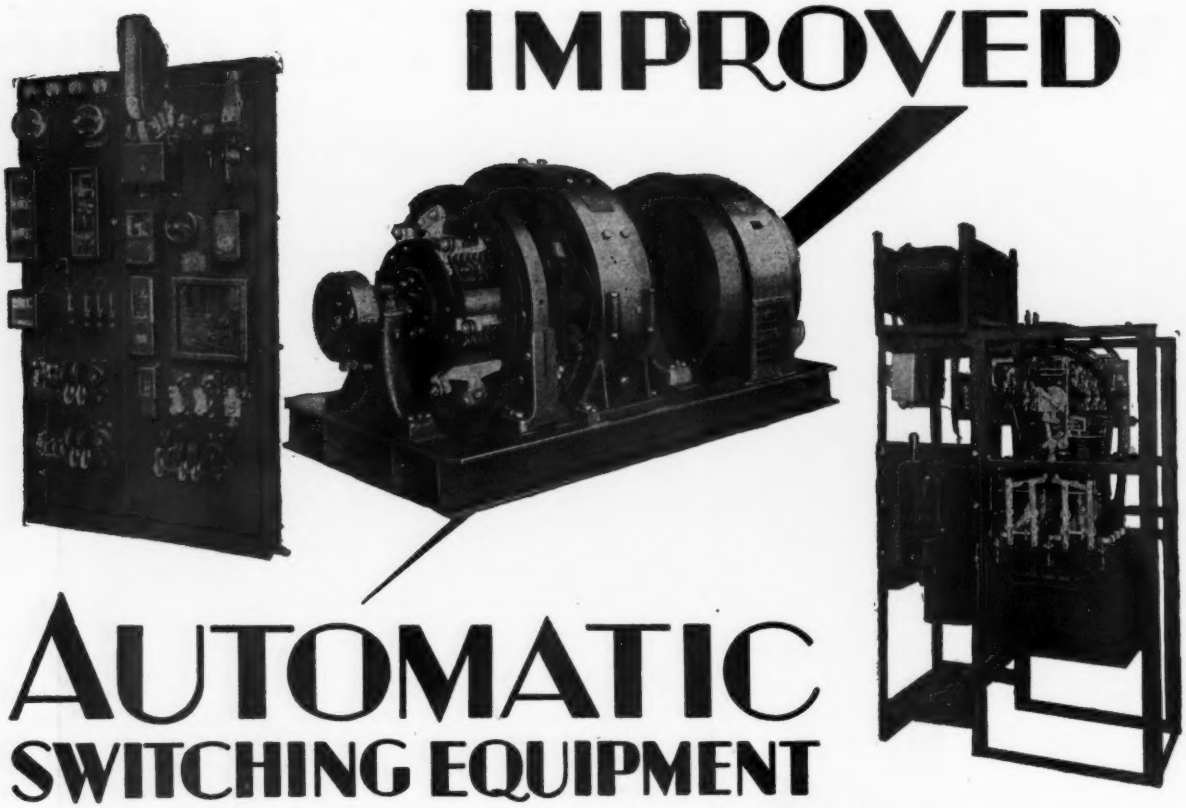
COMPANY	COLLIERY	NO. UNITS	SIZES CLEANED
Lehigh Navigation Coal Co.	Greenwood	2	Rice and Barley.
Lehigh Navigation Coal Co.	Rahn	1	Barley.
Lehigh Navigation Coal Co.	Nesquehoning	1	Barley.
Lehigh Navigation Coal Co.	Tamaqua	1	Rice and Barley.
Phila. & Reading Coal & Iron Co.	Lincoln	1	No. 4 Buckwheat.
Phila. & Reading Coal & Iron Co.	Otto	1	No. 4 Buckwheat.
Phila. & Reading Coal & Iron Co.	Brookside	1	No. 4 Buckwheat.
Phila. & Reading Coal & Iron Co.	Locust Summit	2	No. 4 Buckwheat.
Phila. & Reading Coal & Iron Co.	Good Spring	1	No. 4 Buckwheat.
Lehigh Valley Coal Co.	Packer No. 5	2	Rice and Barley.
Lehigh Valley Coal Co.	Hazleton No. 1	2	Rice and Barley.
Glen Alden Coal Co.	Maxwell	1	Barley.
Glen Alden Coal Co.	Wanamie	1	Barley.
Hazle Brook Coal Co.	Westwood	1	No. 4 Buckwheat.
Hazle Brook Coal Co.	Midvalley	1	Rice, Barley and No. 4.
Stevens Coal Co.	Trout Run	1	Rice, Barley and No. 4.
Haddock Mining Co.	Candlemas	2	Rice and Barley.
Strange Coal Co.	New Philadelphia	1	Rice, Barley and No. 4.
West End Coal Co.	Mocanaqua	1	Barley.

With but two exceptions these installations have been made within the last two years.

The annual yearly output of coal cleaned by the Hydrotator Process totals over 1,150,000 tons.

HYDROTATOR COMPANY
MARKLE BANK BUILDING
HAZLETON, PA.

IMPROVED



AUTOMATIC SWITCHING EQUIPMENT

- - - for use with motor-generator sets rated 2300 volts a-c., 275 volts d-c., 150-300 kw.

You will appreciate these new features:

1. 40% less floor space — a valuable asset in underground installations.
2. Installed in a jiffy — at low cost. (Practically all high-tension wiring done at factory. Installation connections very simple.)
3. Compactness and ease of setting up make it possible to move the station at minimum expense.
4. Greater safety. Switchboard entirely free from high-voltage wiring. Can be worked on with safety. All high-voltage equipment in separate framework, which can be completely enclosed if desired.

General Electric stocks this equipment for immediate shipment, and is prepared to furnish, free of charge, suggested layout drawings for single-unit, surface or underground substations. Your nearest G-E office will care for your needs promptly.

Automatic Switching —

1. Provides protection against a-c. overcurrent, a-c. undervoltage, d-c. overcurrent, d-c. reverse polarity, d-c. undervoltage, incomplete start, loss of generator excitation, overheated bearings and windings, phase unbalance, overspeed, underspeed, etc.
2. Permits substantial savings in operation and maintenance.
3. Permits location adjacent to load centers with resultant improvement in d-c. voltage, and a saving in feeder copper.

500-54

JOIN US IN THE GENERAL ELECTRIC PROGRAM, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

Elasticity with Great Strength

Cosco Troughs are made of special analyses open hearth Manganese steel plate proved by sixteen years' experience most resistant to abrasion and corrosion. Joints are accurately fitted and easily connected.

-because we build them BETTER

SERVICE costs money—no matter who pays for it.

The simplest, surest way to reduce service costs to us and loss of time to Cosco owners, is to build Cosco Conveyors so well that they require the absolute minimum of "time off."

Every detail of construction—not only basic design, but every gear, every bolt, every rivet must withstand the severest usage to which they'll ever be put.

More than four hundred successful installations in American mines speak volumes for Cosco Conveyor design—and the lowest record of "off duty" tells an eloquent story of durable service.

Let us show you positive proof of what Cosco Shaker Conveyor Drives, with the Duckbill, can accomplish in your mines—in increased production at lower cost and surer profits.

CONVEYOR SALES CO., INC.
299 Broadway, New York

District Sales Offices

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Knoxville, Tenn., 2725 Magnolia Avenue.
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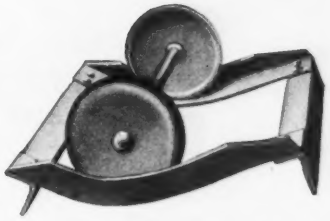
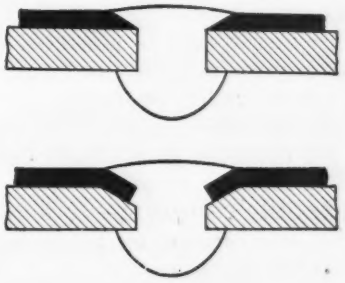
COSCO

Shaker CONVEYOR



Improved Flanged Steel Rollers

Flanged and fixed to axles in one operation. Curved on inner edge to fit cradles perfectly. Infinitely stronger than rollers made from any cast materials.



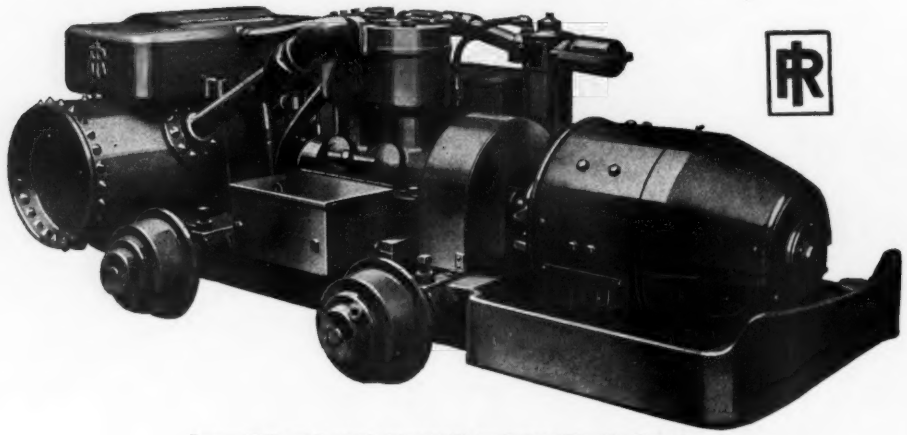
Rivets That Stay Put

Upper illustration shows the usual way of riveting troughs. Note in lower illustration how Cosco Troughs are rivetted. Practically four times as much trough metal is held by the rivet head, making unions that will not easily loosen or tear out.

"Convey Your Coal The Cosco Way"

Ingersoll-Rand Mine Car Compressors

Low Head Room—Low Center of Gravity
Sufficient Track Clearance



Ingersoll-Rand Portable Electric Motor-Driven Mine Car Compressor.

I-R Mine Car Compressors are designed and built especially for mine operation. Each part is a tried and proven member of the assembly.

Essential features:

Steel frame—open type with cross members; ribbed for strength. Twisting and warping have been eliminated.

Wheels—Two Timken Roller Bearings per wheel. Short wheelbase. Adjustable stub axles for different track gauges on some sizes.

Compressor—vertical, duplex. Thrust is downward and is absorbed by the rails. This compressor will not "walk". No wear on wheels, axles, or frame.

Dirt-proof—sealed crank-case. Two sets of air cleaners remove all dust from the intake air.

Flexible coupling—It is unnecessary to move compressor or motor to disconnect these members.

Open Hopper Cooling System—No delicate parts or thin metal sections which sulphuric acid can attack.

Sizes—four sizes each intended for a working pressure of 100 pounds per square inch. Capacities range from 70 to 250 cu. ft. per minute piston displacement.

There is also one "Permissible" mine car compressor for gaseous workings, which has been approved by the U. S. Bureau of Mines. Capacity, 110 cu. ft. per minute p.d. at 100 pounds working pressure. Includes all features mentioned above. Cable reel and self-propelling air motor can also be furnished if desired on the "Permissible" unit.

Full information will be furnished on request.

INGERSOLL-RAND COMPANY - 11 Broadway - New York City

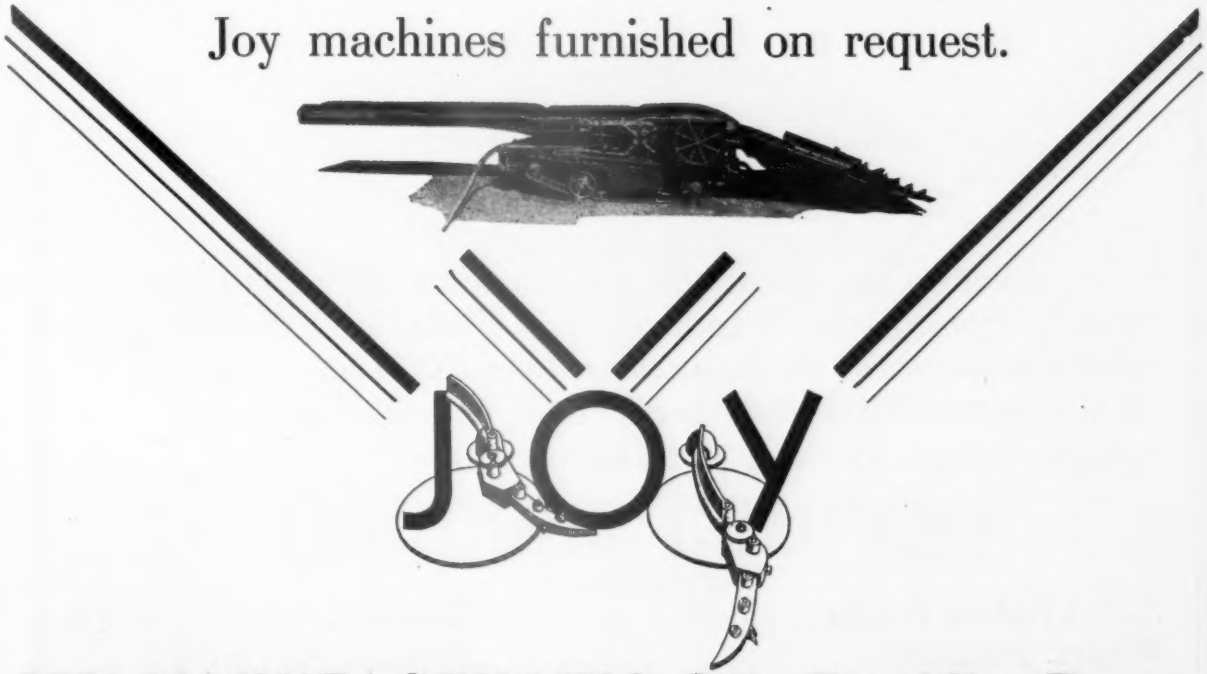
Branches or Distributors in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co., Limited, 10 Phillips Square, Montreal, Quebec

14-MCC

Ingersoll-Rand

The point of mechanical loading is the reduction of handicaps. Faster, safer production at less cost means a more stable market—less suffering from competition. The possibilities of mechanical loading are most fully realized in Joy machines. These loaders are speedy, guaranteed for two tons per minute; they are flexible, meeting the many conditions in coal mining; they are easily handled, one man controlling all operations. The greatest percentage of all mechanically loaded coal is produced by Joys. This is proof of the logic of their design. Let us survey the possibilities of Joy loading at your properties. Names of properties near you using Joy machines furnished on request.



JOY MANUFACTURING CO., Franklin, Penna.

Lehigh Navigation
Hudson Coal
Reading
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Madeira Hill
Glen Alden
Coxe
Rockhill

CHANCE CLEANED COAL

THE COAL THAT FLOATS.

St. Clair
Dodson
Enterprise
New Castle
Kingston
Hazelbrook
Stevens
Langcliffe
Lee

THE CHANCE SAND FLOTATION PROCESS

Is Used By

THE LEHIGH NAVIGATION COAL COMPANY

At Both

ALLIANCE AND CRANBERRY COLLIERIES.

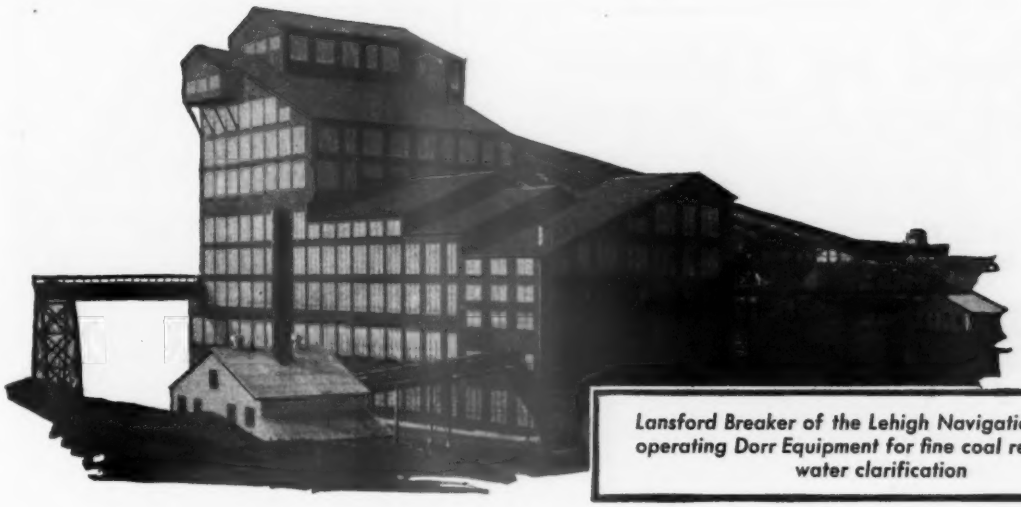
The installation of these plants (each of which treats coal most difficult to clean) increases the annual capacity of operating and building **Sand Flotation Coal Cleaning Units** to over

24,500,000 TONS

Chance Coal Cleaners are washing both 10" Lumps and 1/16" Barley with Standard **Sand Flotation Efficiency** and are operating at capacities up to **300** Tons per Hour. Bituminous Tipples now can be built in which no Lump smaller than 10" need be hand-picked.

H. M. CHANCE & Co.,
DREXEL BUILDING,
PHILADELPHIA, PENNA.

CHANCE COAL CLEANER,
MEARS BUILDING,
SCRANTON, PENNA.



Lansford Breaker of the Lehigh Navigation Coal Co. operating Dorr Equipment for fine coal recovery and water clarification

Dorr Equipment in the Lansford Breaker

A COMPLETE and flexible No. 4 Buck recovery plant is operated by the Lehigh Navigation Coal Company in the Lansford Breaker. Dorr Classifiers are used for dewatering table refuse and for recovery of washed No. 4 Buck.

For water clarification, a Dorr Thickener is operated. It receives a feed of about 4000 gals. per minute of breaker slush carrying 6% solids, 90% of which are minus 65 mesh. The feed is treated with hydrated lime and the clarified water is returned from the Thickener for re-use in the breaker.

If you are troubled with any problem of fine coal recovery, water clarification or neutralization, or prevention of stream pollution, let Dorr Equipment help you out. Our nearest office is at your service.

DORRCO

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CHICAGO, ILL. 333 North Michigan Avenue
LOS ANGELES, CAL. 108 West 6th Street
WILKES-BARRE, PA. Miners Bank Building
ATLANTA, GA. 1503 Candler Building
TORONTO, ONT. 330 Bay St.

THE DORR COMPANY
ENGINEERS
247 PARK AVENUE NEW YORK CITY

INVESTIGATION TESTS DESIGN EQUIPMENT

MELBOURNE, AUSTRALIA Crossle & Duff Pty., Ltd., 360 Collins Street
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LONDON The Dorr Company, Ltd. Abford House, Wilton Rd., S. W. 1
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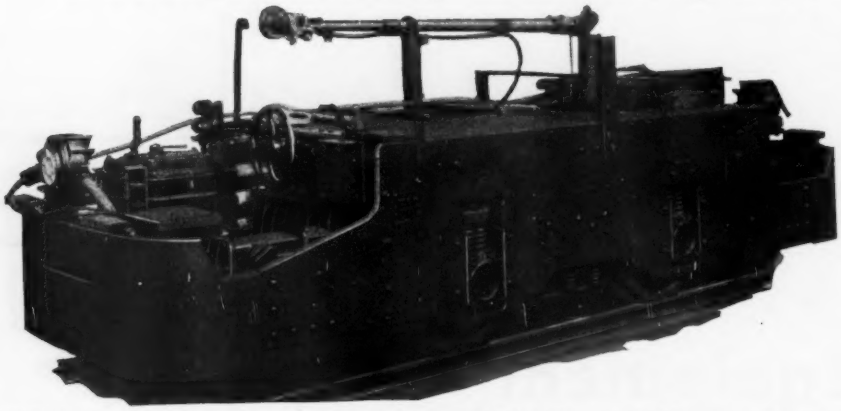
JOHANNESBURG, S. A. E. L. Bateman Locarno House

Chosen by Lehigh

—because of the all-important
SAFETY and ACCESSIBILITY features—
Goodman Safety Gathering Locomotives



One of the 8-ton Combination Trolley and Enclosed Cable Reel Gathering Locomotives at Lansford Colliery.

The performance of these locomotives at the Lansford Colliery of the Lehigh Navigation Coal Company, and in a great many gassy mines in Pennsylvania, Ohio and West Virginia, has established the Goodman Safety Gathering Locomotive as the leader in its field.

Totally Enclosed Electrical Construction—Slow Speed Motors—Semi-Magnetic Control—Alloy Steel Grid Resistance—Motor Driven Electric Cable Reel with 450 ft. of Rubber Covered Double-Conductor Cable—Roller Bearing Axle Boxes—Transverse Equalizer.

Goodman tongue-and-groove construction used on enclosed compartments, make them quickly accessible for inspection without the use of a wrench or screw driver.

Complete specifications and features in Book H-290—Ask for a copy.

For Haulage Lehigh Chose—
Goodman 20-ton 3-motor Locomotives

One of the 20-ton Goodman Locomotives at the Coaldale Mine of the Lehigh Navigation Coal Co. This locomotive has seen 11 years of hard mine service.

Book 230 covers various haulage types.

Intelligent Investigation of Locomotive Construction
Continues to Boost Goodman Locomotive Sales

GOODMAN MANUFACTURING COMPANY
HALSTED ST. at 48TH.
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Locomotives - Loaders - Coal Cutters

PITTSBURGH-WILKES-BARRE-HUNTINGTON, W. VA.-CINCINNATI-BIRMINGHAM-ST. LOUIS-DENVER-PRICE, UTAH

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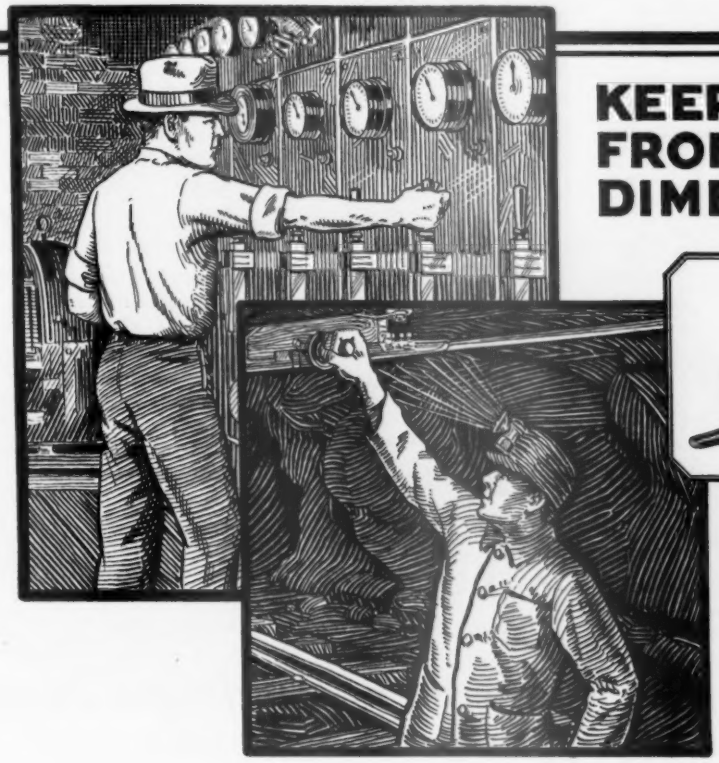
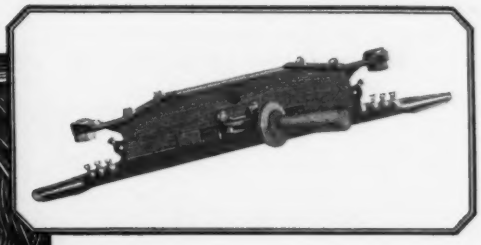


KEEPING DOLLARS FROM WAITING ON DIMES--



Type M Section Insulator Switches

Every care in manufacture is taken by O-B in making this important cost-cutting device. The best hickory, bronze of unusual strength, small tolerance limits, and good castings make O-B Switches the best switches to buy. Turn to pages 560-566, O-B Cat. No. 20.

Two Ways of "Killing the Line"

—but only one keeps the profits alive

MUST you disconnect power back at the sub-station or entry—interrupting all haulage—while adjusting trouble in a trolley circuit? If so, here again is "a dollar waiting on a dime."

Safety First! Kill the line by all means; but do it in such a way that you still keep the profits alive. With a few O-B Section Insulator Switches placed in the trolley circuit at strategic branch points, you can disconnect any section where repairs or extensions are to be made and still keep the rest of the haulageway producing profits. And the finer the degree in which the trolley is sectionalized, the greater the returns in profitable production.

If mine electricians want to save some of the countless steps they take each day in their work—if they and the management are interested in "keeping dollars from waiting on dimes"—here is an opportunity.

Ohio Brass Company, Mansfield, Ohio
Canadian Ohio Brass Co., Limited
Niagara Falls, Canada
1226M

Ohio Brass Co.

NEW YORK PITTSBURGH CHICAGO CLEVELAND ST. LOUIS ATLANTA DALLAS
PHILADELPHIA BOSTON LOS ANGELES SAN FRANCISCO SEATTLE

PORCELAIN INSULATORS
LINE MATERIALS
RAIL BONDS
CAR EQUIPMENT
MINING MATERIALS
VALVES

Extending the dump laterally and longitudinally and gaining elevation at the same time.

All steel construction—one-man operation—complete safety—3-way automatic dumping.

DIFFERENTIAL

STOCK PILING TRAIN WASTE DISPOSAL

DUMPS 3 WAYS

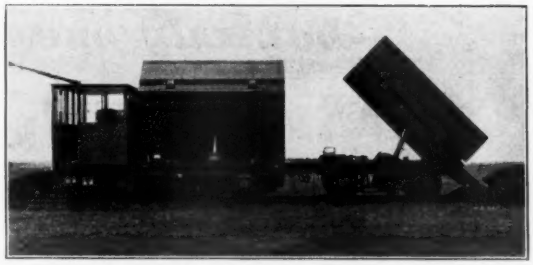
A distinct advancement in the art of building a dump

THE MOST ECONOMICAL EQUIPMENT FOR DISPOSING OF BREAKER REFUSE AND TUNNEL ROCK. SAVES LABOR AT THE DUMP. SPEEDY AND SAFE.

STOCK PILING

May be accomplished at low cost with the differential train and reclaimed with the same equipment with minimum degradation

Furnished with Electric propulsion taking current from trolley wire or third rail. Also with gas-electric drive. Capacity—Level load, 10 cu. yds. each car.



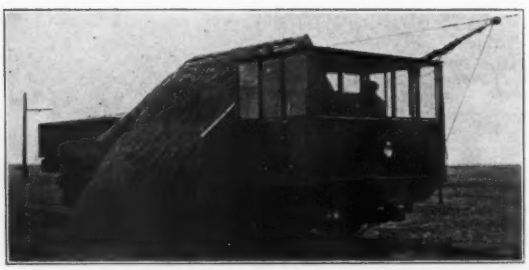
By pushing car ahead in dump position, door may be used as spreader when extending dump longitudinally

Send for Bulletin **D-29**

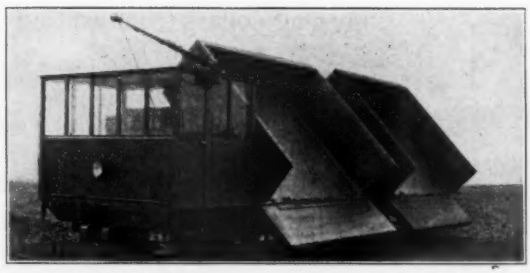
PATENTED

THE DIFFERENTIAL STEEL CAR CO.

FINDLAY, OHIO



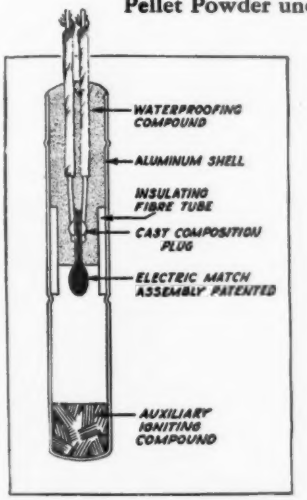
Note how load is cast well away from track.



Steep dumping angle, smooth floor and clear discharge opening.

GIANT All-Metal, Moisture-proof Electric SQUIB

A positive Electric Squib is one which cannot be ignited by friction in the act of tamping; one which is so assembled that moisture cannot desensitize the igniting compound either while the Squib is in storage or when in actual application; and one which will produce a flame of sufficient intensity to ignite either Granular Black Blasting or Pellet Powder under all normal conditions of application . . . . .



The new GIANT ELECTRIC SQUIB more nearly fulfills these conditions than any Electric Squib ever offered.

Inasmuch as the tube of the new GIANT ELECTRIC SQUIB is solid, without vent holes — the water-and moisture-proof plug seals the open end and makes moisture-proof the entire assembly. Moisture and grit, therefore, cannot come in contact with the igniting compound of the match head to either desensitize it through moisture absorption or fire it through abrasion with grit.

Other features of the assembly as shown by the accompanying sectional view are as follows:

The Cast Composition Plug seals and centers the match head assembly; and, together with the fibre tube, effectively insulates it from the shell;

The MATCH HEAD holds the bridge wire embedded within it and prevents this delicate wire from being broken by any jars to which the Electric Squib might be subjected.

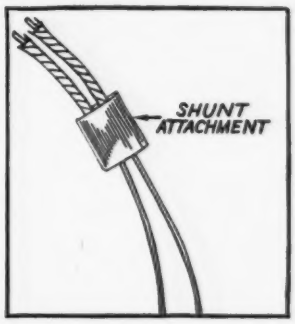
GIANT Electric Squibs are subjected to numerous tests and inspections before they are packed for shipment.

GIANT Shunt Attachment

The Giant Shunt Attachment is a well-worth while safety device that can be supplied at no additional cost with all Giant Electric Blasting Caps and Electric Squibs.

The danger of the loose contact ends of Electric Squibs coming in contact with electric currents in coal mines is ever present because of the extensive use of electrically driven machinery in the mining of coal. Lives have been lost and property has been seriously damaged by the accidental firing of Electric Squibs in this manner. It is well, therefore, that manufacturers have taken steps to eliminate this danger and the Shunt Attachment, designed and patented by the GIANT Powder Company, Con., provides the simplest and most effective protection.

The Shunt Attachment short circuits the bare ends of the leg wires and prevents any electric current that might be collected by them from reaching the Electric Match within the Squib.



The Shunt Attachment combined with the insulation placed within the shell, completely protects the Electric Squib from accidental firing by stray currents.

THE GIANT POWDER COMPANY, CON.

"EVERYTHING FOR BLASTING"

Crocker First National Bank Bldg., San Francisco, Cal.

Branch Offices:
Butte, Montana
Los Angeles, California
Salt Lake City, Utah

GIANT

Branch Offices:
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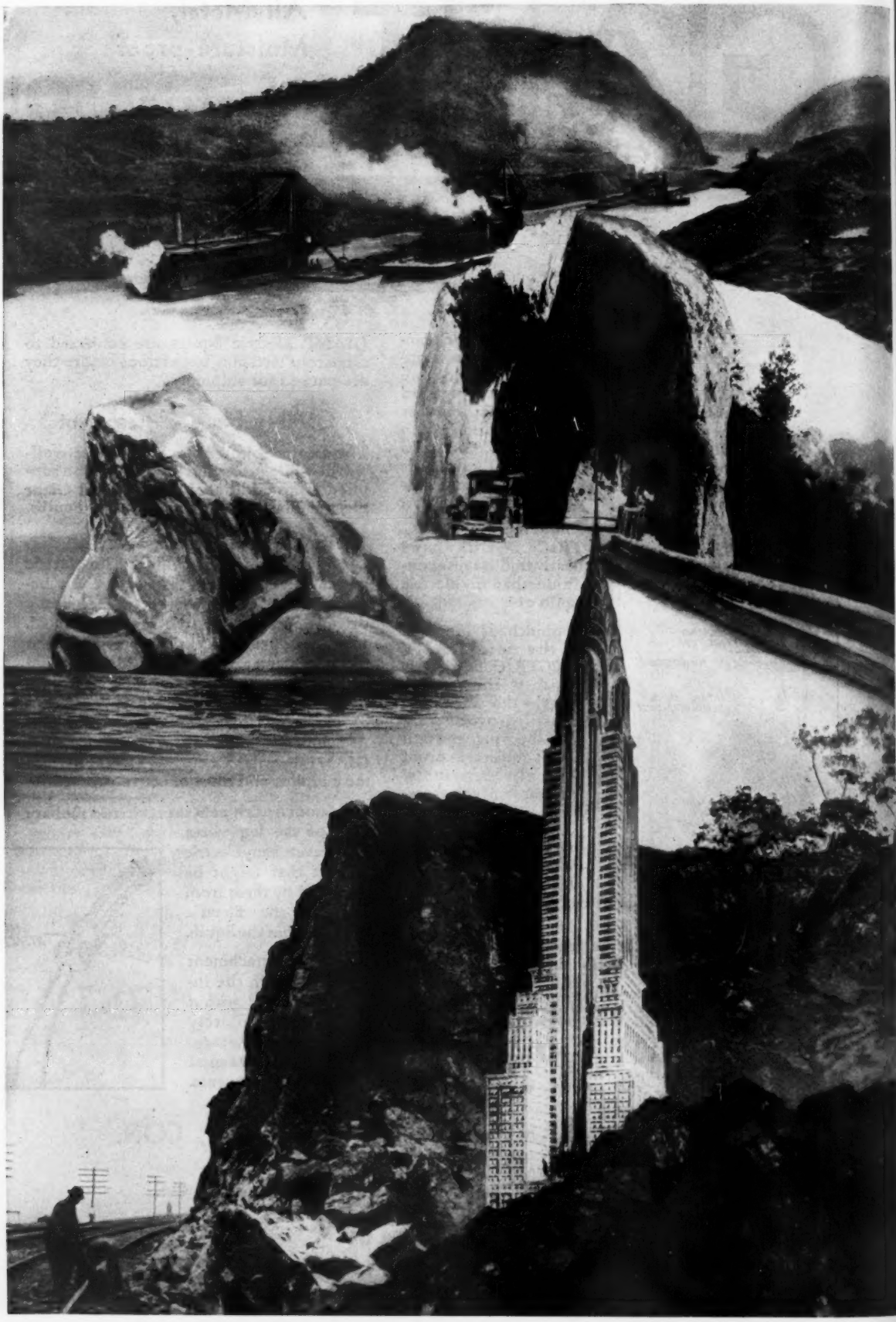


POWER

efficiency . . . economy

No matter what your blasting operation, there's a du Pont explosive to meet your need

IN specifying explosives for different types of blasting, much depends on the kind of explosive. So when you select an explosive for a given job, you want to know these things: How well will it do the job? Has it been made especially to meet and overcome certain conditions? Is it economical to use?

These are just a few of the questions the du Pont Company has asked about explosives in the 128 years it has been making them. Every sort of blasting encountered in the United States has been studied by expert technicians so that the du Pont Company might be able to improve its own explosives . . . might be able to introduce new explosives that would more fully meet your requirements.

The fact that most of the new improvements in explosives have been brought forward by du Pont accounts for their leadership in the field. The reason you can specify du Pont explosives with full assurance is that there is a du Pont explosive specifically designed for *your* job.

For coal mining . . . the du Pont Permissibles and Pellet Powders. For clay, ore, salt and gypsum mining . . . Durox, Gelex, Extras. For quarrying, for road and railroad construction . . . Gelatins, Extras. For excavating, tunneling, shaft sinking . . . the Special Gelatins. And so on.

The du Pont Company publishes a series of Technical Bulletins dealing with methods of blasting, and describing du Pont explosives. These bulletins can help you solve your blasting problems.

We shall be glad to place your name on our lists to receive these bulletins. Write direct.

DU PONT
REG. U. S. PAT. OFF.

E. I. DU PONT DE NEMOURS & CO., INC.

Explosives Department **Wilmington, Delaware**

Timken Heavy-Duty Mill Type Quad Bearings 29½" Bore, 46½" outside diameter, 29" width. Capacity 7,000,000 pounds.

Timken Bearings *are* Licking *the* Toughest Jobs *in* Industry—Hence *their* Vital Necessity *in* Mining Machinery

Sweeping on and up with an irresistible rush, Timken Bearings soar to greater and greater heights of achievement as they are pitted against the toughest jobs that Industry can produce . . . upsetting all pre-conceived ideas of production and production costs—revolutionizing anti-friction requirements . . . brushing aside old theories and traditions to make way for new standards of anti-friction efficiency, economy and endurance.

Terrific pressure loads such as are met in steel rolling mill service—as high as 7,000,000 pounds, are being carried by Timken Bearings in many of the country's largest steel plants.

Hair-breadth accuracy such as is demanded by the finest precision machine tool work is maintained as a matter of regular daily routine.

And thrust and speed and weight and shock—no matter how severe, are handled with equal capability and sureness whether encountered in such widely different types of heavy duty service as automobile operation, paper-mills, transcontinental limited trains, oil field equipment or any kind of machinery.

Wherever wheels and shafts turn, "Timken Bearing Equipped" is the modern symbol of protection and saving.

You need and should demand Timken benefits in mine cars, electric locomotives, conveyors, loaders, hoists, pumps, blowers and other equipment you buy. They are obtainable in most leading makes. The Timken Roller Bearing Company, Canton, Ohio.

TIMKEN *Tapered Roller* **BEARINGS**

The
MINING CONGRESS JOURNAL

**A Monthly Magazine—The Spokesman For The Mining Industry—
Published By The American Mining Congress**

VOLUME 16 JULY, 1930 No. 7

Editorials

COMMON-SENSE

"BUSINESS DEPRESSION" is a favorite topic of discussion. The more we talk the blacker the supposed depression becomes. Let us turn our cloud inside out and see if its lining will help the situation.

—We possess 5 percent of the world's population.

—We do 50 percent of the world's business.

—We have less than 2 percent of our labor unemployed.

—One hundred and twenty million people must be housed, fed, clothed, transported and amused.

—We are still producing and consuming yearly about 600,000,000 tons of coal, 2,000,000,000 pounds of copper, 675,000 short tons of lead, 610,000 short tons of zinc, and 70,000,000 gross tons of iron ore.

—While 1929 was the greatest year in our history, 1930 does not need to rival it to spell prosperity.

—Because of the wisdom of our President, business has pledged itself to maintain wages and production, and millions are now being spent in necessary improvements in plants, factories, mills and mines.

Stop *talking* depression. There is no need for pollyanaism but there is a desperate need for the utilization of common sense.

Anthracite

THE story of anthracite, told in this issue, is one of continuous battle—battle for markets; against unfair taxation; freight rates; and labor unions. Even its inception was fraught with difficulty, since its early promoters were accused of fraud in offering "black stone" for coal. Since 1807 this industry has faced continuous problems. Its history is replete with how those problems have been conquered. The big fact, of course, is that they have been met and that anthracite today, faced with tremendous issues, paying only 4 percent on its capital, and obliged to find new markets, employs 150,000 people, has a pay roll in a year of normal production of more than $300,000,000 and spends approximately $75,000,000 each year for supplies and replacement equipment. Through its pay rolls, supply purchases, payment of local taxes, etc., this industry each year distributes about $400,000,000.

Its history shows that this great industry has continually faced the "new market" problem. At one time anthracite was an important blast furnace fuel; it was for many years an important factor in the manufacture of water gas, and at one time it had practically a monopoly on the kitchen fuel supply. In 1890, the steel industry used 2,500,000 tons of anthracite to feed its blast furnaces. Since 1925 no anthracite has been used for that purpose. Formerly between four and five million tons were consumed in the making of water gas. But these markets have given way to cheaper coke oven gas from by-product coke plants.

The life of anthracite has been closely woven in the political history of the state of Pennsylvania, but it was not until 1913 that the industry became a national political football. From 1914 to 1923, anthracite was subjected to 14 judicial, legislative, administrative, Federal and state investigations. In that period its taxes increased from $5,600,000 to $28,000,000, or 400 percent, and the famous Pennsylvania state tonnage tax became effective, constituting approximately one-fourth the latter sum.

Add to these tribulations, the labor difficulties which are directly at the root of today's most serious problems, and you see an industry beset on every hand by a multiplicity of difficulties that only the strong can withstand. But the spirit of the industry is manifest in the words of that able champion of anthracite—Mr. E. W. Parker—in a recent address, when he said of their troubles, "Those of the past have been met and solved; those of the present are in the process of solution; and the future can take care of itself."

The present tone of the anthracite industry manifests itself in a resolve to work. The past year has seen the

coordination of a great industry in a masterful manner. Their problems are receiving collective and cooperative thought; stabilization is a word that has genuine meaning to the industry, and there is no uncertainty in the present trend of action.

Intensive work is being done toward the education of the consuming public. Combustion advisors are active in the entire trade territory as far west as Milwaukee. The matter of burning devices is being taken up as a means of teaching the public the proper handling of anthracite as a household fuel. In the production departments of the industry, preparation is being given preferred attention, as evidenced not only by the construction of new plants, but as well by the installation of improved equipment. Operating problems are receiving intensive study with the result that there is a new life and an increased measure of modern equipment. Mechanization is rapidly entering the field, and although still in its early stages, much can be hoped for through this means of simplifying production problems.

Today the industry is facing its problems fortified by an intensive sales campaign, by improved preparation, by efficient cooperative service between the producer and the dealer, and by cooperation on the part of labor, and there is every reason to believe that it will meet its present-day problems and those of the future with the same ability it has demonstrated in the past. If severe punishment develops character, the anthracite industry is well qualified to receive the laurel wreath. Let alone, it will add to the wealth, prosperity and comfort not only of its state (for anthracite comes from one small area of 500 square miles within the state of Pennsylvania) but to the country.

Anthracite adds its voice to that constantly growing majority in demanding that industry be "let alone."

Our Pet Pauper

A RECENT article in the *Wall Street Journal* contributes some interesting comment on the coal industry, which it entitles "Old Pauper Coal." Because of its source, we quote in full:

"Were it not for coal, industrial progress would be slow indeed, and development of the country's resources at the pace recorded over the past quarter of a century or more would have been next to impossible. Coal is the basis of almost everything industrial, and the United States has centuries' supply of it. It is because of its great abundance that the industry is disorganized and demoralized. No industry is more in need of stabilization than coal.

"This country produces 500,000,000 tons of it annually. Without it there would be little steel produced and electricity might be a fourth-rate industry. Development of the automobile would have been impossible without coal and the railroads would be minus one-half billion tons of freight annually. By-products of coal contribute billions of wealth and wages. It is one of the most useful of all basic products.

"Yet coal is contributing little if anything in the way of dividends or interest to people who have invested their money in that industry. What is more, it is directly contributing little to the consuming power of the people. A miner who can work at his job only six months out of twelve hasn't the wherewithal to buy automobiles and radios or possess his own home.

"Thirty years ago conditions in the steel industry were similar to what they are now in coal. As a result of cooperation the steel industry is now a well-organized and stabilized industry. Its workers are big consumers, and as big consumers help to make the country prosperous. Some day the coal industry, which is the basis for products that contribute millions annually to the wealth of the country, will be stabilized, but not until there is cooperation like that in steel, copper, and many other rich and prosperous industries."

The coal industry has been called many things, but this is the first time it has been indicted as a pauper. And the indictment isn't true. As a whole, coal has not been prosperous. Its profits are spotty. It has been disorganized. Try, with the combined wisdom of all its critics—and their number is legion—to bring centralization in an industry composed of more than 7,000 units, and judge with what speed success will be met.

Coal has not asked sympathy. It has asked only to be let alone. To have the God-given privilege of settling its own difficulties. But the wisdom dispensers, like the garrulous mother-in-law, attack, berate, ridicule and shout from the house-tops that coal is the industrial incompetent and, the mass of humanity reading only the headlines, accept the theory and spread the indictment.

Assuming that 7,000 mines are engaged in the production of coal, there are more than 10,000 people consuming coal to one man producing. The very cheap coal furnished in times past, when the coal was near the surface, before rivers of water had to be pumped before the coal could be mined, when transportation was much cheaper, when wages were much lower, when retailers were satisfied with a small profit as compared with present prices, makes of each of these 70,000,000 people a protestor against paying what is today a fair price for his fuel.

It would take shouting indeed to reach above such a din with the commonplace fact that the industry produced more than 500,000,000 tons of coal last year, and that 80 percent of that 500,000,000 tons was produced by less than 2,000 mines, and that it is the remaining 5,000 mines who can not find markets for their product who help swell the din and create the pauper idea.

Not an enviable position for the coal industry. But eventually there will emerge from the chaos the giant that is slowly and painfully gathering its strength and coordinating its muscles. For coal has brains and strength and power. And not always will it permit the shouters to obscure accomplishment and ability.

Practical Results

IN AN address presented at the Cincinnati Convention, Mr. F. G. Tryon, of the U. S. Bureau of Mines, gave the figures for the production during the year 1929 with mechanized loading equipment. These figures have a double interest, showing that there was a total production of over 40,000,000 tons of mechanized loaded coal and that this is an increase of 75 percent over the preceding year. In view of the fact that for the past several years mechanization has increased at a fairly uniform rate of 50 percent a year, the greater growth made during the year 1929 may indicate that the curve of production has taken a definite upward swing.

Four states—Wyoming, Montana, Illinois and Indiana—each produced more than 25 percent of their output with mechanized loading, and these figures serve to show conclusively that in these states at least, mechanization is becoming the accepted practice. Every coal producing state is using loading equipment to some degree, although their percentage is not as great as in the Central and in the Rocky Mountain field.

The increased tonnages for 1929 are the result of two causes. First, the installation of new equipment; and second an increased production through improved operating methods with machines that have been installed during preceding years. It is a source of great gratification to those who have sponsored the mechanization of coal mines to have their judgment justified by the practical results which are evidenced by the 1929 production figures.

Silver and Prosperity

THE price of silver has reached the lowest figure in the history of the country—34 cents per ounce. Less than 10 years ago the world market price of silver for a short time was at $1.38 per ounce. During the 10-year period from 1917-1926, inclusive, the New York market price of silver was 77.99 cents per ounce. During the five-year period 1922-1926, inclusive, during which period the Pittman Silver Purchase Act was not a factor, the average New York market price of silver was 65.806 cents per ounce.

We have repeatedly said that we do not believe that it is the function of government to legislate prosperity into any line of business, but it is a matter of grave public concern when the visible wealth of more than half the people of the world shall be reduced from a 10-year average of 77.99 to 34, with no promise that it may not drop another 50 percent before the second 10-year period shall expire.

China and India have been the principal consumers of silver and represent more than one-half of the world's population. Already the depressing price of silver has cut in half the purchasing power of those countries. What greater economic disaster can come to a people than the destruction of half its wealth? The United States, seeking an outlet for its surplus production, can cherish no hope for new markets in that direction.

The Kemmerer Commission plan, to put China upon the gold standard, calls for a new currency to be established upon the basis of a gold standard fund to be maintained in China and in financial centers abroad which shall consist of at least 35 percent of the face value of all gold standard coins issued. The stocks of uncoined silver in China are immense, and any plan which contemplates demonetization of this silver would cause chaos in China and a further glutting of the silver market.

Perhaps even the suggestion is in a measure responsible for silver's present plight.

It is an interesting fact that the present low price of silver affects approximately 60 percent of the world's population. India and China, with 5,000,000,000 ounces of hoarded silver and over $300,000,000 in coinage, find their visible purchasing power reduced over one-half. Yet England and America find their chief markets for petroleum and raw cotton in China, and the United States leads the world in supplying leaf tobacco and machinery to the Far East.

With our export trade in these and many other communities curtailed more than one-half, through this debasement in silver, the problem becomes acute, not only to the silver producer but to every manufacturer of goods which go into our export trade. Without this normal outlet over-production and accumulated goods must inevitably react in employment and industrial stagnation.

It is, therefore, a matter of supreme concern to every American business man that silver should return to a normal value, which will permit of its continued production and will afford purchasing power to those nations dependent upon it.

In our February issue we advocated an International Silver Conference, pointing out that the great bulk of the world's silver is produced in the Western Hemisphere, with Canada, Mexico, Chile, Bolivia, Peru and the United States producing four-fifths of the world's silver. These countries have no association with each other, and the silver industry in each is blindly fighting against extinction. We further said:

"No one country can meet the situation. The entire extinction of the silver-mining industry in any one of these countries would not materially affect the general situation. It is necessary that all shall act together to justify any hope of betterment. The healthy operation of every industry is important to general prosperity. Each cog in the wheel must do its part if the machinery of business is to run smoothly. Silver is so closely associated with other metals that it is peculiarly important.

"We suggest the importance of a conference of the silver countries of the Western Hemisphere for consideration of some means by which these vastly important business problems centering in the silver-mining industry shall find some means of solution."

Again we urge an International Silver Conference.

Prophets and Prosperity

FOR many weary months the country has waited for the obstructionists in Congress to exhaust their many schemes to prevent an orderly revision of the tariff. During this waiting period, business has been hampered by the uncertainty which must prevail when the value of goods to be bought or sold is likely to be increased or decreased by the success of a trading minority independent of both political parties and seeking partisan advantage through its control of results by uniting with the less patriotic factions of either party.

At last the Hawley-Smoot bill has been passed by both houses of Congress and approved by the President. The wails of the pessimists and the predictions of the prophets will soon be put to the test. Senator Watson, majority leader of the Senate, says that "within 30 days the Nation will be on the up-grade financially, economically and commercially." The chairman of the Democratic National Executive Committee says that "the bill is an economic crime and a political blunder."

We venture the prediction that, notwithstanding the inevitable world trend toward lower price levels caused by an inadequate world gold supply, the enactment of the tariff bill marks the beginning of better business conditions throughout the United States.

Purchasing Power of the Mines

THIS issue presents a great unit of the mining industry. In one of the articles the author tells something of what anthracite contributes to our national prosperity. It is surprising to learn that this industry spends in any normal year of production some seventy-five million dollars for supplies and replacement equipment. This sum does not take into account any expenditure for modernization, but relates only to necessary expense.

Recently The American Mining Congress, through its Bureau of Mining Economics, made an investigation concerning the purchasing power of the mines. The result was most informative and amazing. For instance, taking the industry in the units into which it is geologically divided, a large coal company, representative in production of at least 50 of the great producers, spent more than a million and a half for supplies and replacement equipment. Multiply this sum by 50 and the result is quite a sizable market, isn't it? It is common knowledge that approximately 90 percent of our more than 500,000,000 tons of coal is produced by less than 2,000 companies. So this is a somewhat conservative estimate.

One large copper company, representative of the group of great producers, spent almost three millions for its necessary supplies and equipment. This expendi-

ture may be multiplied by at least 10 to secure a fair estimate of the purchasing power of that industry. A large lead and zinc property spent approximately one million, and an iron ore producer nearly three millions. In addition, as is shown by another statement in this issue, our export trade in 1929 amounted to better than seventeen millions of dollars for the manufacturer of mining machinery. Certainly the mining industry offers a great market—one worth cultivating.

Legislation for Oil

URGING the unit production plan as a solution to the over-production problem of the petroleum industry, the Federal Oil Conservation Board has issued its fourth report to the President. The unit system is an arrangement under which operators tapping any particular pool agree upon the amount of oil that is to be produced during a given period of time. It also determines the amount of oil any operator may produce.

The Board states that the estimate of oil reserves have been far too conservative, but does not attempt to say what the estimate should be. It points out that crude oil increased its production 12 percent in 1929, and that the stocks of oil have accumulated rapidly, until at the beginning of this year the supply amounted to approximately eight months' demand.

The Board also stressed the need of legislation whereby the rights of the various owners in the unit operation will be recognized and protected. Acting upon this suggestion, the Public Lands Committee has introduced in Congress a bill looking to proper oil conservation based upon the recommendations of the Board. According to its authors, this bill is designed to more properly conserve the natural resources of any single oil or gas pool or field, and authorize permittees and lessees under the leasing law to unite in operating under a cooperative or unit plan of development or operation of the pool when determined and certified by the Secretary of the Interior to be necessary or advisable in the public interest. To assure continuous protection of the public interests, the terms and operation of any such unit plan shall at all times be subject to the approval of the Interior Secretary, who, by the legislation, "is authorized in his absolute and uncontrolled discretion to establish, alter, change, or revoke drilling, producing and royalty requirements, and otherwise to make regulations in connection with the institution and operation of any such cooperative or unit plan." Any lease heretofore or hereafter issued that has become the subject of a cooperative or unit plan of development, and having the approval of the Interior Secretary, shall continue until termination of the plan and not be subject to the present 20-year limit. The new bills permit oil and gas leases held by one person to 7,680 acres in any state and 2,560 acres in a geologic structure of the same producing field, in contrast to the present law which restricts each person to three oil or gas leases in a state and one in a producing field. A change is also proposed regarding leases or permits to coal, phosphate and sodium lands. The new bills would authorize any one person to hold 2,560 acres of such lands in any one state, while the present law restricts the holdings to one lease.

Unit operation is beset with many inhibitions, but it can not be worse than the present system, where overproduction, glutted markets and waste of basic materials are joined together. The experiment will be watched with eager interest, particularly in the coal fields where conditions are even worse than in the oil industry.

Oil-Shale and Potash

WHAT does the man on the street know about oil-shale and potash? He has heard of them, to the effect that both are useful, and he knows that we have plenty of oil and potash from some source or other. But does he know our future source of oil when the present supply has been exhausted, and from where we can get potash in time of national emergency? In general, he does not. But the Federal Government does and, through the Bureau of Mines, it has recently enlightened the public by means of two important reports which, although requiring years to procure the information, are available at the low price of 70 cents and 25 cents.

The first report is Bulletin 315, "Construction and Operation of the Bureau of Mines Experimental Oil-Shale Plant, 1925-1927," by M. J. Gavin and J. S. Desmond. An engineer, resident in Colorado and who has examined miles of shale country, says: "This seems to be a splendid contribution. It probably is and should be the most valuable treatise on the oil-shale possibilities."

Two excerpts from this report are pertinent:

The work at the experimental plant has demonstrated that shale-oil can be produced with reasonable satisfaction from American shales by retorts of a type now available for large-scale operation. * * * Certainly the value of oil-shales as a source of fuel for our Navy, in time of national emergency, has been demonstrated.

The American refining companies which cooperated in this study consider the shale-oils inferior to petroleum for refining. * * * The results of the refining studies do not favor shale-oil as a substitute for petroleum at the present time. The need for shale-oil will probably not come in the immediate future. However, when substitutes for petroleum are urgently needed, shale-oil products will probably be seen in a more favorable light. * * *

The Bureau's Bulletin 210 on oil-shale in general, published in 1922, could be profitably read with Bulletin 315.

The second report is Bulletin 316, "Commercial Possibilities of the Texas-New Mexico Potash Deposits," by J. S. Wroth. An engineer who specializes in nonmetallic minerals and knows his potash, says: "This is one of the finest pieces of work I have ever seen from a Government Department. The Bureau and Mr. Wroth both deserve great commendation."

A perusal of this publication reveals the infinite care taken in the selection of drilling sites, which was done by the U. S. Geological Survey; the examination of cores; the possibilities, mining, and treatment of polyhalite—the sulphate of potash, lime, and magnesia; the American market for potash salts; the effect of foreign production and imports; and an estimate of the cost of producing potash in Texas and New Mexico. The following excerpts may be made from Bulletin 316:

Polyhalite beds of sufficient size and thickness to be economically mined and treated are known to occur in western Texas and southeastern New Mexico.

A process for the treatment of polyhalite to recover refined sulphate of potash and sulphate of potash-magnesia has been evolved, and these products, together with lower grade mixtures of crude and refined salts, can be produced at a cost that enables them to be sold at a profit in the principal markets of the United States in competition with foreign potash salts.

In the carboniferous period perhaps tropical vegetation such as this covered our present coal bed areas. Millions of years passed before these forest growths became coal

Some High Spots *in the* Earlier History *of the* ANTHRACITE INDUSTRY

Geologically the anthracite fields of northeastern Pennsylvania are of the same age as the bituminous fields of the Appalachian and Mississippi Valley States, both having had their origin in the carboniferous period. At this time in the world's history, countless ages before man inherited it, dense tropical forest growth and other vegetation flourished in the areas now occupied by our coal beds. It has been estimated that more than 700 years of this forest and vegetable growth were required to produce one foot in thickness of bituminous coal. Even a longer period was required to produce a foot of anthracite

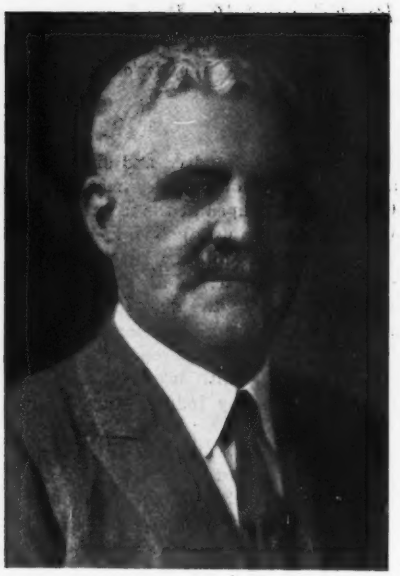
The house of Judge Jesse Fell, in Wilkes-Barre, where anthracite was first burned in 1808

By Edward W. Parker,
Director, Anthracite Bureau of Information

ONE hundred and sixty years ago, a company of pioneers, mostly from Connecticut, camped at the mouth of Mill Creek in what is now known as the Wyoming Valley, and near what is now the city of Wilkes-Barre, Pa. One of these made a report of the discovery of anthracite and of iron ore near the camp. Tradition has it that seven years earlier, in 1755, a gunsmith used "stone coal," brought to him by Indians, in his forge near Nazareth. This legend lacks probability and the discovery at Mill Creek is generally accepted as the beginning of the history of the anthracite industry. Six years later, or in 1768, Charles Stewart in surveying the Manor of Sunbury, on the other side of the river, noted the occurrence of "stone coal" on what is known as Rose Hill. The first use of this mineral fuel appears to have been made in 1771, when Obadiah Gore, a blacksmith, who had come into the locality two years before, set up his forge and worked it with anthracite as fuel.

The discovery of anthracite proved of much benefit to the colonists in their struggle for independence, for in 1775 and subsequently until Cornwallis surrendered and the War for Independence was ended, the Proprietary Government of Pennsylvania loaded some of the new fuel on flat boats and floated it down the Susquehanna to Harrisburg. From there it was hauled by wagon to Carlisle, where it was used in the manufacture of arms for the Continental Army. Even in these early pioneer days the superior attractions and qualities of anthracite as a domestic fuel were recognized and commented upon, for John David Schopf in his Travels (1783) speaks of "a bed of brilliant black coal near Wyoming that was said to burn without odor and would not soil the fingers when it was handled."

A conspicuous figure in these early days of anthracite was Judge Jesse Fell, of Wilkes-Barre. Although a blacksmith by trade, Judge Fell was decidedly a man of parts, having served as sheriff of Luzerne County for two terms, as brigade inspector of militia, and was associate judge of the same county from 1798 until his death in 1830. In 1788 Judge Fell used anthracite in his nailery, and in February, 1808, successfully burned it in a grate, of which experiment he made a note as follows: "February 11, 5808 of Masonry, made the experiment of burning the common Stone Coal of the Valley in a Grate in a common fire place in my house and find it to answer the purpose of fuel, making a clearer and better fire



merger of a coal mining and a navigation company into the Lehigh Navigation & Coal Company (incorporated the following year as the Lehigh Coal & Navigation Company) brought the anthracite industry into being. They shipped that year 365 tons to Philadelphia and while considerable difficulty was encountered in selling it, they succeeded, and their faith in the future of the industry was rewarded. In 1822 White and Hazard shipped and sold 1,073 tons; the next year 5,800 tons, and in 1824, 9,500 tons, and the trade was established. Vignettes of White and Hazard decorate the stock certificates of the Lehigh Coal & Navigation Company to the present day.

Michael Gallagher
President, The Pittston Company

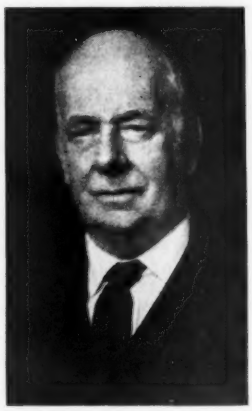
William W. Inglis
President, Glen Alden Coal Company

at less expense than burning wood in the common way." The house in which Judge Fell lived was torn down in 1905.

Naturally, the records of the quantity of anthracite actually produced and sold in these early days are somewhat wanting. The first quantity statement extant is that in 1807 Abijah Smith & Company shipped 55 tons down the river from Plymouth. Five years later, and 50 years after the discovery at Mill Creek was made, the first attempt to reach the Atlantic seaboard, by a Colonel George Shoemaker, who, the records show, took nine wagon loads from a mine near Pottsville to Philadelphia, but how much coal was in a wagon load was not stated. Colonel Shoemaker had his troubles. The people were not familiar with the new fuel and suitable stoves or grates for using it had not been developed. The colonel was accused of being an impostor in that he was trying to sell black stones as coal. His reputation was saved by the firm of Mellon & Bishop, owners of a rolling mill in Delaware County, who were induced to make a trial of it and found it made a better fuel for melting iron than the fuel previously used.

White and Hazard were important factors in the early development of the anthracite industry. Although credit for the first attempt at making shipments by water to the Atlantic seaboard belongs to the Northern, or Wyoming, region, as in 1815 William and Maurice Wertz hauled some coal by wagon from Carbondale to Honesdale and "arked" it from there by the Lackawaxen and Delaware Rivers to Philadelphia,* it was White and Hazard who, in 1820, by a

MEANWHILE developments were under way in other parts of the region. In 1823 the Delaware and Hudson Company was incorporated and in 1829 the first shipment by rail and water was made to New York City, the coal being taken by a gravity road from Carbondale to Honesdale, thence by canal to Rondout and from there by the Hudson River to destination. The Southern, or Schuylkill region was made accessible by the completion of the Schuylkill Canal in 1825, from Philadelphia to Mt. Carbon, over 5,000 tons being shipped out in that year and nearly three times as much the following year.



E. W. Parker
Director, Anthracite Bureau of Information

For a score of years water transportation, either by river (partly slackwater navigation) or by canal, held sway, but when the industry had obtained its majority, it demanded something more dependable, and more efficient. Waterways, helpful as they were in the early days, soon proved inadequate to meet the increasing demand. They lacked mobility. They could deliver directly only to points along their courses, and only during a portion of the year. If yards ran out of coal in the winter season there was no more to be had until navigation opened. During the period of water transportation four large canal routes were established, each of the three divisions of the anthracite region having one or more water outlets. Only one of these is in existence today, the canal of the Lehigh Coal & Navigation Company from Mauch Chunk to Easton, and it presents its owner with a substantial deficit every year. The water systems were supplemented by a species of transportation peculiar to the anthracite region—gravity roads. Because of their unique character, these gravity roads deserve a more extended treatment than is possible within the limits of the present paper. As anthracite carriers they have disappeared, but one is still operated as an amusement for tourists between Summit Hill and Mauch Chunk. A story is told of one of these gravity roads where the empty cars were hauled up the grade by mules, who rode down with the loads in their own car. On one occasion when the mule Pullman was forgotten in the up haul, the mules refused to walk down the grade and a detail of men had to be sent to the foot of the grade and push the car to the top for its passengers.

As the gravity roads furnished a link between the mines and the waterways, and disappeared with them, so with the

* This venture was evidently not a financial success, only two of the three arks started reaching their destination after a seven-day trip, and the experiment was not repeated until 1823.

Richard F. Grant
President, Lehigh Valley Coal Corporation

A. J. Maloney
President, Philadelphia and Reading Coal and Iron Company

advent of the railroads another type of auxiliary transportation came into being, the inclined plane, by which loaded cars, a few at a time, were raised by cable hoists from the valleys to the mountain tops, where they were made up into trains for shipment, this method being found more economical than the employment of extra locomotives to haul the loaded trains up the heavy grades. The first of these planes from the borough of Ashley, a suburb of Wilkes-Barre, to the top of Wilkes-Barre Mountain was completed in 1843 and is still in operation. It is owned and operated by the Central Railroad of New Jersey. Two other planes, the Gordon, at the west end of the Mahanoy Valley, and the Mahanoy Plane, at the east end (the one completed in 1854 and the other in 1862) did, and one still does, similar service for the mines of that valley and the Reading Railroad. The Gordon Plane was abandoned late in the last century, but the Mahanoy Plane (illustrated in this article) continues to operate. It has been estimated that more power is required to raise the loaded cars to the tops of the mountains than is employed to transport them to tidewater, which is for the most part down grade.

The period from 1820 to 1840 in the history of anthracite was the period of water transportation, but in the latter half of that period the need for more efficient methods of transportation from mine to consumer became increasingly apparent, and beginning with 1830 the era of railroad projecting and building began in earnest. Encouragement to railroad construction had been given by the modest but successful enterprise of the Delaware & Hudson Company which, in 1826, had been given authority to construct and maintain a railroad to bring its coal to its canal and in 1827 the New York legislature went so far as to lend the credit of the state to provide the company with funds. The first anthracite was shipped over this short bit of line in 1829. For the next few years there was considerable activity in railroad building but most of the lines were short ones from the mines to navigable waters, until in 1842 the Philadelphia & Reading Railroad completed its railroad to Philadelphia and the first all-rail shipments to tidewater were made. Then railroad building began in earnest, but it is not possible in a paper of this kind to do more than touch the high spots. Suffice it to say that in 1843 the Lehigh Coal & Navigation Company completed its line of railroad from White Haven to Wilkes-Barre, subsequently, in 1866 and 1868, extended to Scranton and Easton, and leased in 1871 for 999 years to the Central Railroad of New Jersey. In 1851 what later became the Delaware, Lackawanna & Western System entered the field as the Leggitt's Gap Railroad, and in 1852 the Central Railroad of New Jersey was built to Easton, but did not secure all rail connection with the coal region until it secured the lease just referred to. In 1836 the Pennsylvania leg-

Percy C. Madeira
President, Madeira, Hill & Company

F. W. Leamy
Senior Vice President, The Hudson Coal Company

James Prendergast
President, Susquehanna Collieries Company

SCENES TYPICAL OF THE OLD AND THE NEW IN ANTHRACITE MINING AND PREPARATION

Above: "Where Steam and Gravity Meet." Gravity plane at Olyphant, Pa., with breaker built about 1860

Left: Mule car

Old and new in breaker construction. The one shown above was built in the latter part of 19th Century and is of frame construction. That to the right is built entirely of steel, concrete and glass, steam heated.

islature had granted to the Hazleton Coal Company, which was later merged into the Lehigh Valley Railroad Company charter rights to mine, transport and sell coal. The bogey man of railroad ownership or control of anthracite mines had not at that time risen to fright the souls of timorous politicians. On the contrary, such ownership was encouraged and fostered as a beneficent means of forwarding the development of a valuable natural resource. State credits were extended to aid the enterprises for which otherwise it would not have been possible to secure the necessary funds. The Delaware, Lackawanna & Western Railroad was, by its charter, authorized to mine, purchase and sell coal as well as to transport it.

The coordination of the mining and transportation interests in the early days of the anthracite industry was essential to its economic development, though it has been charged and may be admitted that through these various affiliations there arose, during the next half century, certain abuses such as discrimination in freight rates, car distribution, etc., against operators not affiliated with or subordinate to the railroad interests. Such charges met a receptive public and political state of mind, and resulted in vigorous and political attacks upon the association of mining and carrier interests as creative of and fostering monopolistic control and therefore anti-social. Monopoly became

"A monster of so hideous a mien
That to be dreaded needed but to be seen."

The helpful attitude of government that had prevailed was reversed and through investigation, litigation and legislation, the affiliations formerly encouraged became anathema. During a period of 10 years from 1914 to 1923, inclusive, the anthracite industry was subjected to no less than 14 investigations, some judicial, some legislative, some administrative, some Federal, some state, and it is worthy of note that in not a single case had anything in the conduct of the anthracite industry been found to have reacted unfavorably or prejudicially to the public. Indeed, one commission in the report of its investigation which had been thoroughly and efficiently conducted, in exonerating the industry of any acts inimical to the public, had the temerity to say: "While the conclusion of the commission will doubtless not be popular, it is founded upon the bald facts developed by this investigation and it is, therefore, impossible under these facts that your (the legislature's) commission should find other than they do."

However, in 1915, the the entire structure of railroad ownership or control of coal mining operations was attacked by the Federal Government in what is known as the Reading case and in 1921 a decree was entered ordering the complete segregation of the several interests which has since been done, not only in the Reading case but also the Delaware, Lackawanna & Western, and the Lehigh Valley. The Pennsylvania Railroad, whose interests in coal mining properties had not been acquired, like the others, in accordance with charter rights, did not wait for a court decree but, in 1917, sold its anthracite interests to the Susquehanna Collieries Company, a corporation organized for the purpose by M. A. Hanna & Company, of Cleveland, Ohio. In 1927 the Delaware and Hudson Company sold its coal properties to the Hudson Coal Company.

BUT I've gotten a little ahead of my story, and to return. As has been said, the period from 1830 to 1860 was one of railroad projecting and building, but it was notable for another development, that of the beginning of the use of anthracite in the manufacture of iron. It is just 100 years ago, or in 1830, that a Dr. Geisenheimer is said to have succeeded in making pig iron with anthracite, but neither to him nor to any one else was awarded the prize offered by the Franklin Institute to the first one who would make 20 tons of pig iron with anthracite as a fuel. But it came into actual use about 1840 and from then to 1875 may be considered the period of anthracite iron. Charcoal had from the beginning of iron making been the fuel. In 1855 in this country anthracite became the premier fuel, obtaining its highest point in 1890, when it in turn began to give way to coke, the use of which starting about 1850, made more rapid strides than did anthracite and finally in 1925 drove it from the field. At the high point of anthracite iron

making, about 1890, some 2,500,000 tons of anthracite were fed to the blast furnaces, but the decline from that peak was precipitous, as in 1910 only 727,000 tons of anthracite made pig iron; 10 years later only 65,000 tons were reported as so used, and in 1925, not a ton.

Anthracite cost less to produce and was much cheaper in the anthracite period of iron making than it is today. In 1908, for instance, the price of broken coal at the mines was $2 a gross ton. Today the circular price for broken is $8 and very little is made. In that earlier time, too, anthracite was of no little importance as a locomotive and steamboat, as well as a blast furnace fuel. "Lump" coal was used by the iron makers, while "steamboat" and "broken" were the chief steam sizes. But as anthracite was driven out of the blast furnace by coke, so did bituminous coal supplant it as a boiler fuel.

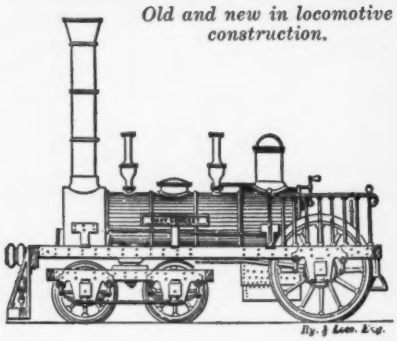
NATURALLY, no other preparation was necessary for these large sizes than separating them from the slate or rock and possibly passing them over bull screens. When the demand for them ceased it was necessary to break them down in order to produce the sizes the trade demanded. Unfortunately, we have no statistics of the production of anthracite by sizes earlier than 1890, but as that was the year the decline in the use of anthracite as a blast furnace fuel began, it makes a fairly good base for the odious comparisons we have to make.

In that year of 1890 the production of lump and steamboat coal constituted 11.8 percent of the total, while broken coal made up 12.7 percent. In other words, practically 25 percent of the product was of sizes larger than egg. The output of the sizes below pea coal, i. e., buckwheat No. 1 and smaller, was only 10.2 percent. But the whole product had to be disposed of and into the jaws of the toothed rolls went the lump and the broken to be masticated down to the digestible sizes, until in 1928 only 0.7 percent of the total production was of sizes larger than egg. On the other hand, we find that exclusive of the colliery consumption which is largely composed of the small sizes, the breaking down of the larger sizes resulted, in 1928, in 28.8 percent of the product being of sizes smaller than pea coal, while if pea coal be included among the smalls, considerably more than one-third of the total. About 4,000,000 tons of the steam, or junior, sizes in 1890—over 18,000,000 tons in 1928. Lump and steamboat coal was sold at a profit*; the price of pea coal at the present time is from 50 cents to $1 below the cost of production, while on the sizes below pea the loss is from $3.50 to nearly $5 per ton. The total loss in a normal year on these sizes, which are unavoidably produced, is about $75,000,000, which must be recovered from the realization on the domestic sizes.

The first of the factories, to which the name "breaker" has been given, in the anthracite region, was probably the Diamond Breaker of the Delaware, Lackawanna & Western Railroad. At least we have no record of an earlier one. It was built in 1852. Up to 1840 all the coal had been shipped as mine run, and a common sight in Philadelphia was a householder breaking the coal on the street in front of his house. John G. Hines, of Pottsville, a visitor to the city, observed this. He conceived the idea that this work should be done at the collieries, and the dust and fragments too small to use in the heating apparatus of the time should be screened out. At his suggestion, a revolving screen run by steam power was erected at Port Carbon, the coal being broken by sledges, at first on wooden platforms and then on perforated iron plates. In 1845 breaking of the coal by machinery was

Old and new in anthracite preparation. The breaker boy or slate-picker, and one of his mechanical successors, a modern jig.

* The *Coal Trade Journal of* April 21, 1880, quoted the price of Lehigh lump at $8 per ton, with grate and egg coal at $4.98 and stove and chestnut at $5.23, these prices being at Chicago.



Old and new in locomotive construction.

begun, the machine being capable of breaking 200 tons a day. But, as that did the work of 40 or 50 men, it was an economic success. The original complete breaker was built in the Wyoming region, but it was four or five years after the pioneer work. In fact, credit for a good part of the pioneer work in the preparation of anthracite goes to the Schuylkill region. From 200 tons in a 10 or 12-hour day for the first breaking machine in the Schuylkill region to 5,000 tons in an eight-hour day in the Truesdale or Loree breakers is quite a step.

AS AT one time an important blast furnace fuel, so was anthracite for a period of years, especially during the last quarter of the nineteenth century and the earlier years of the present one, an important factor in the manufacture of water gas. For this purpose broken coal was principally used. Since, however, increasing costs, principally in labor, have compelled advances in the prices of anthracite to practically four times what they were back in the "90's," the use of anthracite for gas making became unpopular and has been almost entirely discontinued, although the manufacture of water gas far exceeds that of coal gas and coke-oven gas combined. In 1890 the production of broken coal amounted to 4,657,000 gross tons, mostly used for making water gas; in 1928 it was 382,015 tons, although the total production of anthracite in 1928 was 60 percent larger than it was in 1890. So broken coal has gone into the rolls and been broken down to add to the supply of "steam sizes."

When, in 1876, at the Centennial Exposition, the first electric lamp was exhibited, it was looked upon as an interesting scientific toy, without promise of becoming an effective competitor with gas as an illuminating agent. But today electric illumi- (*Continued on page* 561)

No. 1 Slope Fans, Reynolds No. 16 Colliery. Old and new in fan construction. The old in the foreground of rough frame construction, and the new, to the left, is steel and fireproof.

The Mahanoy inclined plane.

A breaker, the village, and the coal.

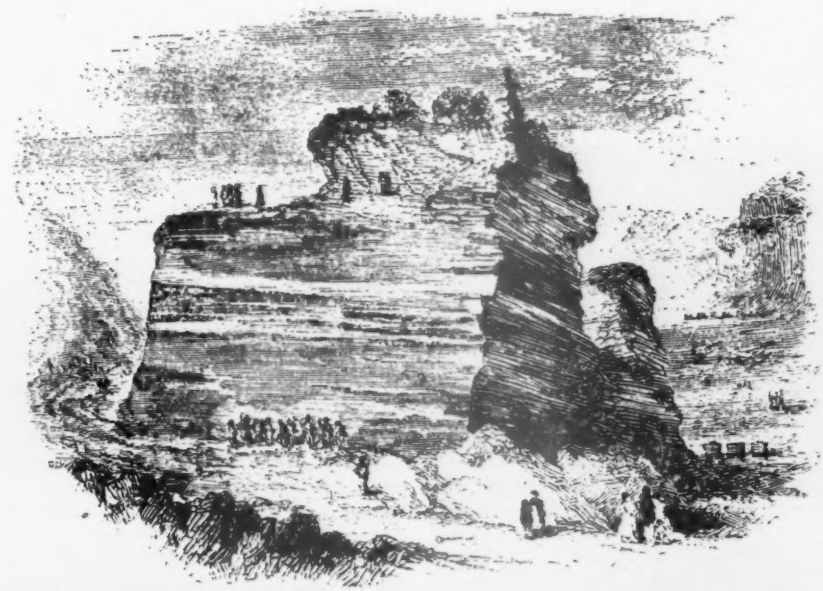
Early Mining Methods in the Anthracite Field

By Eli T. Conner *

Grassy Island Shaft, 1860

THE subject assigned to me, i. e., "Early Mining Methods in the Anthracite Field," has been so thoroughly described by many eminent historians and engineers that it seems unnecessary to attempt to enlarge upon this well-known story. However, it may be worth while to consider the beginning of what has grown into such a great basic industry; to remind ourselves how from small things much greater things have grown.

The first quarter of the nineteenth century, sometimes referred to by historians as "the era of good feeling," witnessed rapid growth in population largely moving westward. The necessity for better means of transportation was more and more brought home to business people and Government officials, hence the movement for the construction of the Erie Canal, which was put into service in 1825, the Potomac and Chesapeake Canal projected by George Washington, and many others. During this interesting period in the history of our country, the great majority of the inhabitants were dependent upon wood for heating their dwelling houses and upon charcoal for fuel in the blast furnaces, which, of course, at that time were very small. At the seaboard there were importations of coal from England and Wales, and from the James River Basin near Richmond, Va., and about 1836 by canal from the Georges Creek region of Maryland. All of this coal was of the bituminous variety, except a small amount of fuel from the Richmond, Va., Basin, known as natural coke.



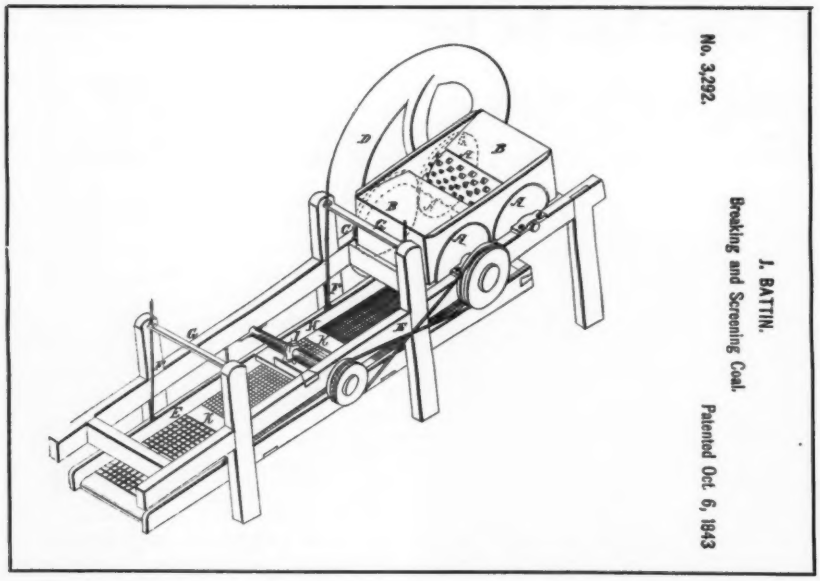
The Great Open Quarry of the Lehigh, from an old woodcut in Harper's Magazine

The bituminous coal received at tidewater ports was a good deal of a luxury, and, on account of the poor roads and consequent cost of transportation, was available in the coast cities and but a short distance inland therefrom.

On account of the conditions briefly described, far-seeing business men were attracted by tales told by hunters, travelers, and others, of large deposits of "stone coal" to be found in a comparatively limited area of northeastern Pennsylvania. It had been known for years that a certain grade of coal of a hard, brittle nature and brilliant black color was to be found outcropping in gulleys and along streams in what are now known as Dauphin, Northumberland, Schuylkill, Carbon, Columbia, Luzerne, and Lackawanna Counties. It was generally known that some coal mined in the Wyoming Valley had been floated in arks down the Susquehanna River to Carlisle, Pa., where it was used in the manufacture of arms for the Revolutionary Army. However, attempts by various enterprising individuals to transport and sell sample lots of coal from this region were not very successful at first. The principal reason for this was that "stone coal," as known to most of the people who had any contact whatever with it—I mean the imported article—kindled readily and burned with a long flame and some smoke, while the sample lots from the vicinity of Pottsville, Mauch Chunk, and Carbondale, which by great effort were transported to Philadelphia, could not be ignited by the ordinary method with which people were familiar. Of course, now it is well know that the reason was and is the small percentage of volatile hydrocarbons found in anthracite as compared with bituminous, so that it was almost by accident that a sample lot transported from Mauch Chunk in 1814 by Miner, Cist & Robinson was burned in a boiler at a wire mill of White & Hazard at Falls of Schuylkill just outside of Philadelphia.

As a result of this experience, individuals, including White & Hazard, and Mr. Josiah White, who was the first chief engineer of the Lehigh Coal and Navigation Company, took a lease upon 10,000

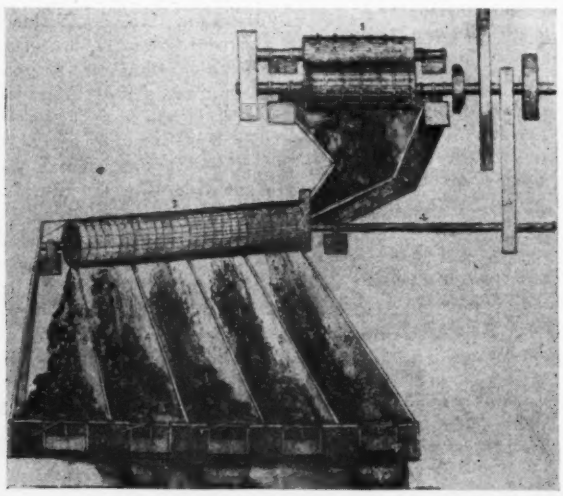
* Consulting Mining Engineer, Scranton, Pa.

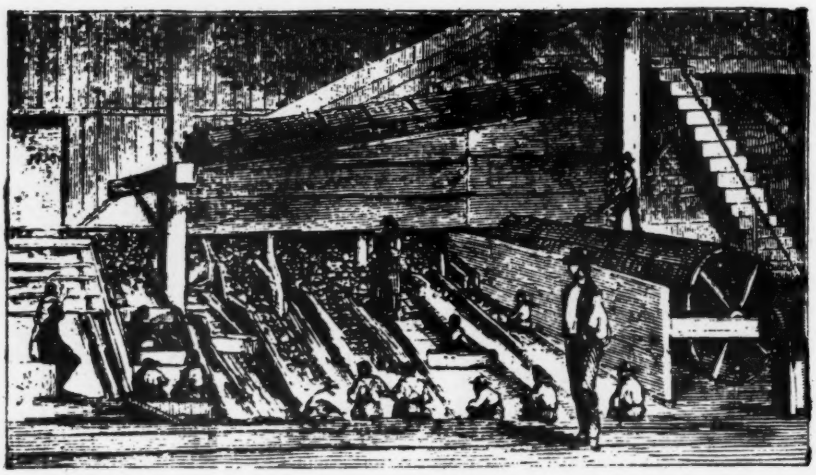


Patent Office drawing of an early invention for preparing and sizing anthracite

acres of land of the Lehigh Coal Mine Company near Mauch Chunk for 20 years, the royalty being "one ear of corn per year, if demanded."

These enterprising pioneers then began the construction of the Lehigh Canal. For a time the coal mined at Summit Hill was transported in wagons to Mauch Chunk and loaded upon arks, which were floated down the unimproved Lehigh River. Usually only about half the arks got through with their cargo to the Philadelphia market, the balance being wrecked en route. After the completeion of the Lehigh Canal about 1828, the growth of the anthracite industry from that area, i. e., Mauch Chunk and Summit Hill, 9 miles from there, was rapid.





Woodcuts of old time coal breakers

The early activities at the mines were by the open-pit and stripping methods. The Mammoth Bed, where it had been discovered by the hunter, Philip Ginter, in 1791, was between 60 and 70 ft. thick, and the overburden varied from 0 to 18 or 20 ft., so that it was a simple matter to take off the earth and the small amount of rock and "quarry" the coal. (See picture from *Harper's Magazine*.)

The means of transport from the mines to Mauch Chunk was by the Gravity Railroad, which was the first railroad constructed in this country, known as the Switchback, which is still in service as a scenic route. The cars loaded at the mine were transported by gravity to a point on the hillside above the river at Mauch Chunk. For some time this coal was dropped down in chutes to the river and there loaded in canal boats. Later a portion of it was dropped by gravity in the original package coming from the mine. The smaller coal was carried down in long chutes from Upper Mauch Chunk to the canal boats in the river below. These chutes were still in service for that purpose when I was a boy. Mauch Chunk was my birthplace and also the birthplace of my father.

The coal as mined at that time was shipped as run of mine, i. e., lumps and smaller sizes mixed. It was soon learned, however, by the producers that to get the best results from anthracite, which is the name by which it became known after about 1835, it should be broken into fairly uniform size, consequently the dealer for a time broke it with hammers and picks, and the smaller sizes thus made was of little use. The producers then found it necessary to give some thought to preparation of their product at the mines. With the well-known inventiveness of engineers and others, methods of breaking and screening into marketable sizes were soon developed and adopted by the producer. One of the earliest inventions of which record is available was by J. Battin, who about 1843 brought out what is known as the Battin roll and screen. This invention was adopted by producers, and to illustrate it I append a print thereof as obtained from the Patent Office.

It will be noted that this was not only a breaking device but screening it over shaking screens. It was very soon realized by producers that preparing the coal in the manner I have just described resulted in considerable loss in small sizes, which at that time it was believed could not be used successfully in any kind of a furnace. The question of making valuable the smaller sizes from that

E SUN

NEW YORK, TUESDAY, SEPTEMBER 3, 1833. [PRICE ONE PENNY.

AGENCY FOR LACKAWANA COAL.—2000 lbs. to the ton. The Corporation of the weight of Anthracite Coal, from 2,240 lbs. to 2,000 lbs. making it conform to the statute of the State, the price of new Lackawana Coal therefore will be 50 cents less per ton of 2,000 lbs. viz.—$5 50 for clean unbroken lumps, from the barge; $6 50 for broken, screened, and delivered.

All orders that have been received and the coal not yet delivered, if not otherwise requested, will be delivered at the old price, $6 large; $7 broken, for the long ton of 2248 lbs. JONES & WURTS,

Agents for the Delaware and Hudson Canal Company.

Office of the Union Coal Yard, corner of Chamber and Washington streets. s3d

An early advertisement of anthracite, and on the right, two of the founders of The Delaware and Hudson Company.

William Wurts

Maurice Wurts

time to the present has been followed with interest by producers. In the very early days only sizes from lump to the size now known as stove were considered marketable, the small coal being disposed of on waste banks at the mines, or, in some instances, left underground.

I stated before that my father was born at Mauch Chunk in 1833. When he was a young lad, his stepfather and mother lived at Summit Hill; and when he and his brother, Eli, were quite young in the summer time they worked in the coal breakers, and later, as they grew, they served in the engineering corps of the Lehigh Coal and Navigation Company. My father told me that the first coal breaker, when he was quite a youngster, was an Irishman working on the plates, i. e., perforated plates over which the coal as dumped from the mine car passed. He was equipped with a sledge hammer and a pick, and his job was to "crack" or "break" the big lumps so that they would go through the holes in the perforated plates. He evidently lost his job when the Battin roll was invented.

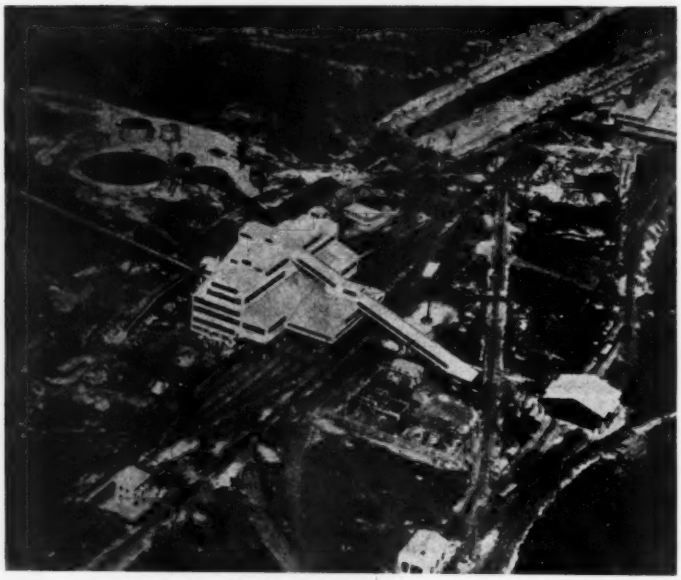
To illustrate the kind of plant then used and designated as a coal breaker, there are presented old woodcuts of one of the old-time structures at Summit Hill. From this it will be noted that there was a small pair of rolls below the dumping point with a cylindrical screen to size the broken coal, and chutes in which boys were employed to remove the impurities. There is also included a picture of a modern plant, i. e., Marvine Breaker, of the Hudson Coal Company, which has a capacity of between 6,400 and 6,500 tons of marketable product per eight-hour day.

In addition to the things which had to be learned—how to prepare and how to burn "stone coal" or anthracite—the inventiveness of machinists and others was called upon to produce stoves. Prior to the advent of anthracite in the eastern markets, practically all the heating appliances of dwelling houses, etc., were open grates, which were designed to burn wood and bituminous coal, but which were unsuited to the new fuel—anthracite. It is a matter of history that a closed stove had been invented by Benjamin Franklin—this was suitable for burning wood and bituminous coal. The Franklin stove was later redesigned to some extent so that it was suitable for burning anthracite. Quickly thereafter there were many types of heating stoves developed, such as the Morning Glory, the Baltimore Heater, and the Dockash kitchen range, and closed furnaces for central heating in the basement of dwelling houses. All of these devices were highly creditable to the inventiveness of the people.

About the same time that the Lehigh Coal and Navigation Company was making these developments at Summit Hill and Mauch Chunk, two enterprising citizens of Philadelphia, the Wurts brothers, William and Maurice, were making extensive excursions for the purpose of discovering "stone coal" in quantity in what is now Lackawanna County. They found what they sought along the Lack-

Above, old rake used for sizing coal after it had been shot off the solid face. Right, raked material left in mine. This raking practice was discontinued about the time of the Civil War

awanna River at what is now Carbondale and bought several thousand acres of land. From these they mined coal, which was hauled over Moosic Mountain to the Delaware River and floated in arks to Philadelphia. This was about 1822, and while they reported they had some labor and travail to get their product to market, they did succeed in selling the coal to various persons. Lackawanna coal is what is known as free-burning white ash. In that respect it is of a somewhat different nature from the harder varieties of anthracite from the Lehigh and Schuylkill regions. The Wurts Brothers succeeded in developing their property and obtaining a charter from the States of New York and Pennsylvania for the construction of a canal from Honesdale on the Lackawaxen to Rondout on the Hudson River. This was the property of the Delaware & Hudson Canal Company, which was then successfully launched and has been a large contributor to fuel needs of the country ever since.

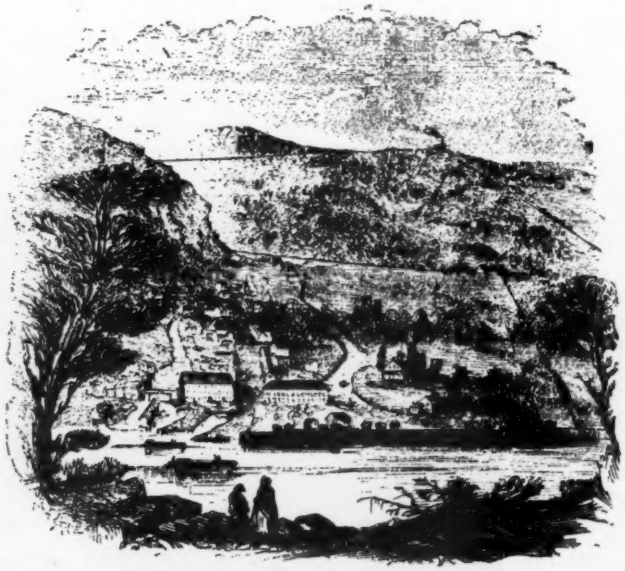


Aeroplane View of New Locust Summit District Central Breaker Looking Northeast—Philadelphia & Reading Coal & Iron Co.

In like manner to the experience of the Lehigh Coal & Navigation Company at Summit Hill, the early mining practice of the Delaware & Hudson Company at Carbondale was by the open-pit or stripping method. At that point the coal lies in three layers or beds aggregating about 22 to 24 ft., with 3 to 5 ft. of intervening layers of slate. When the easily won coal at the surface was approaching exhaustion, they then followed the coal beds under cover. The coal measures at Carbondale are comparatively flat and the overburden relatively light.

In like manner to the experience of other producers, it was soon found that only the larger sizes of coal could at that time be readily marketed. For this reason, in order to avoid the expense of transportation, etc., of an unmarketable product, there was adopted at Carbondale, and at other developments in the northern anthracite field, the practice of "raking" the coal after it had been shot off the solid face in the mine chambers. Only the larger sizes or pieces were loaded out by the miners and laborers and sent to the surface and thence to market. The materials which passed through the tines of the rake was shoveled back into the mine openings and left. To illustrate this there is shown a photograph of an old rake which was found in an abandoned mine opening. There is also shown a photograph of the material which was discarded and left behind by this practice.

The practice of "raking" in the mines, so far as the records disclose, was discontinued about the time of the Civil War. In recent years, when old workings of that early period have been redeveloped for recovery of pillar coal, the material that was discarded by the practice of "raking," embracing coal of sizes from stove down, is loaded out, prepared and shipped to market.



Mt. Pisgah Planes and Gravity Railroad Lehigh District, from an old woodcut

In the interesting record disclosed in the history of the Delaware and Hudson Canal Company, entitled "A Century of Progress," published by that corporation upon the one hundredth anniverasry of its organization, was an account of a serious catastrophe, which occurred on January 12, 1846, at Carbondale. This was a sudden collapse of a portion of the mine from which coal had been excavated, suddenly closing all of the main routes leading to other parts of the operation and causing the death of 16 men. So far as I have been able to learn, this was the first great mine disaster in connection with coal mining in this country. Several years ago, in the course of reopening old and abandoned mine workings, an opening was made into a chamber or gangway within the area of the squeeze of 1846, and a miner discovered in this opening the skeleton of one of the victims of that disaster. Evidently the miner had found it impossible to get out, as all avenues were closed. He was found sitting with his back leaning against a coal pillar.

The remains were taken to the colliery office and kept there for a long time in an endeavor to identify the victim and to find some of his kin, but without success, so they were then decently interred in one of the local cemeteries.

In Schuylkill County there is a legend that a hunter named Necho Allen discovered "stone coal" on Broad Mountain about 1790. The story is that he had been on a hunting trip and was overtaken by nightfall, so he made camp and built a fire. During the night he was disturbed by the excessive heat from the fire; upon examination he found that the wood he had used had all been consumed, but some pieces of black "stuff" like stones burned. Allen had heard of "stone coal" and realized that he had fortunately found it at an outcrop from the surface.

This became known and 22 years later Col. George Shoe-

A Modern Anthracite Breaker—The Hudson Coal Co. Capacity, 6,400 to 6,500 tons per day

maker of Pottsville, carted nine wagonloads to Philadelphia. He sold two loads and was later denounced as an imposter by the purchasers and was compelled to give the rest away.

The Schuylkill Navigation Company was organized in 1815 and the canal was built from Philadelphia to Port Carbon in 1825.

Contrary to the methods pursued at Mauch Chunk and Carbondale, the Schuylkill territory was quickly invaded by many people who desired to get coal land and start operations. This resulted in "wild speculation" in coal leases, etc., with the inevitable consequences later of bankruptcies, failures, etc. The early developments in the Schuylkill area were in gaps in the mountains, where the coal beds are exposed standing on steep pitches, and where water-level gangways could be driven and chambers therefrom to the outcrop in the mountain. Later, when it became necessary to go below water level or meet the extra cost of pumping water, many of the "mushroom organizations" collapsed.

In common with the experience at Summit Hill and Nesquehoning, where the Lehigh Valley and Navigation Company developed methods of attack, winning the coal on steep pitches by what is known as the "shrinkage stope method," similar practices were adopted in Schuylkill County. The great Mammoth Bed was the only one exploited to any considerable extent in these early days. Standing on very steep pitches, as it usually does, it was and is necessary to double timber all main gangways and airways. The practices adopted in the early days have prevailed down to the present; in fact, there have been but few improvements in the manner of winning the coal since those very early days.

The methods of preparation before described were generally adopted in Schuylkill County. To illustrate one of the early collieries operated by Conner & Patterson in Schuylkill County, see the reproduction from an old wood cut.

Comparison of the pictures I have submitted of ancient preparation plants with modern practice is illuminating. There is also included with this article a photograph of the new breaker of the Philadelphia & Reading Coal & Iron Company at Locust Summit. This breaker has an expected capacity of 12,000 tons per day.

Authorities for foregoing statements:

The First Geological Survey of Pennsylvania, by Henry Darwin Rogers, published in 1855.

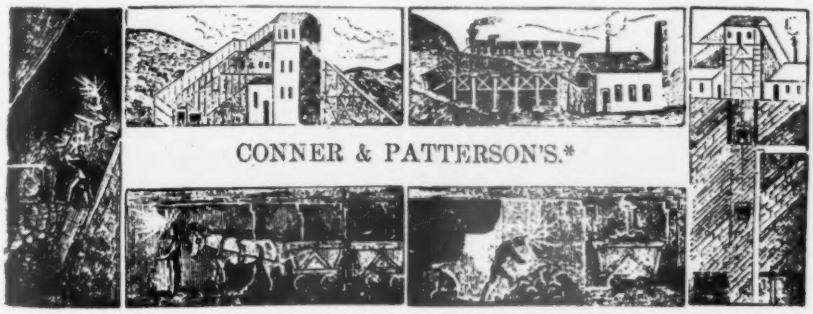
"A Century of Progress," published by the Delaware & Hudson Company in 1925.

"Coal, Iron & Oil," by Daddow and Bannan, published in 1866.

"Josiah White's Diary," written by himself, covering the period from 1812 to 1846.

Photostatic copy of a "Report by Richard C. Taylor on Coal Lands, Mines and Improvements of the Dauphin & Susquehanna Coal Company, and on the Condition and Prospects of the Stony Creek Coal Estate," published in 1840.

Also personal and family data.



Another woodcut of early anthracite mining scenes

EARLY HISTORY OF ANTHRACITE
(*From page* 556)

nation is general and there is probably more house lighting done by kerosene than by gas. The gas companies, forced gradually out of the illuminating field, sought other markets for their product, with the kitchen range as the most promising "prospect." A highly successful campaign with "Cook With Gas" as the slogan was inaugurated and resulted in a wider use of gas for that purpose than it had had as a creator of light. It was not only a boon to the apartment house dweller, it found favor with the home owner or renter, and anthracite in stove and chestnut sizes, which until then had enjoyed a practical monopoly as a kitchen fuel was forced almost as completely from that field as was lump coal from the blast furnace, "steamboat" from the ocean liners, and broken from the gas retorts.

These are a few of the problems the anthracite industry has been compelled to face in the past. Present ones are no less serious. Not the least of them are the losses of markets caused by the interruptions to a steady supply by the entirely needless strikes of 1922 and 1925-26, each of which lasted five and one-half months, and which the operators did all that was humanly possible to prevent. The later one, which occurred during the fall and winter, was the more serious in its results, as consumers were compelled to have recourse to competitive fuels, which have strenuously endeavored to maintain the foothold thus secured. Intensive sales efforts, improved preparation, and efficient service rendered cooperatively by producers and dealers, have recovered some of the lost markets. Whether all will eventually be recovered or not, particularly in the northwestern states and Canada, is a question. In these efforts the main obstacle to complete success is the high range of prices which the industry has been compelled to impose upon the domestic sizes, and to which reference has already been made as having caused the loss of market for broken coal in the gas making industry. How this price situation is to be relieved is a real problem. Wages in the anthracite industry have not, as in other industries, receded from the inflated wartime levels, but have, on the contrary, been augmented, the "peaceful" mediation of Governor Pinchot in 1923 having imposed an additional burden of 10 percent on an already burdensome labor cost. By increased mechanization and other economies, the industry is endeavoring to overcome these handicaps. Effective cooperation on the part of labor through the elimination of restrictions on the productive efficiency of the miners and otherwise would help the situation materially. (*Continued on page* 571)

ANTHRACITE'S CONTRIBUTION to our National Prosperity

By
Noah H. Swayne *

ANTHRACITE'S contribution to prosperity has been exemplified more in what it has done for others than in what it has accomplished for itself and the investors in the industry, for, a general impression to the contrary notwithstanding, the anthracite industry, taken as a whole, has never been what might be called a money maker for itself. In the census year of 1909 it was shown that the average return on the capital invested was approximately 4 percent. The actual difference between total cost and realization was $14,712,294, or about 20 cents a gross ton. The mining census of 1920 did not undertake a study from which comparisons could be made with the figures compiled by the previous census, but five years later a resolution introduced into the United States Senate by Senator La Follette called on the Secretary of the Treasury for a statement showing the amount of income taxes paid by the anthracite producing companies in the year 1924, which preceded the strike of 1925-26 and was, in fact, the latest year of normal activity. The letter from the Secretary of the Treasury in reply to the resolution showed that of 139 operating companies 47 paid Federal income taxes—that is, they made some profits—while 92 companies paid no income tax, showing that they either made no profits or actually lost money. The tax-paying companies showed net incomes aggregating a little over $28,000,000. The non-profit-making companies (92 of them) had losses totaling $7,000,000, so that the net profits on the industry as a whole in that year were between $21,000,000 and $22,000,000, which, on the commercial production of that year (71,689,000 gross tons), means about 30 cents a ton, and this on the capital invested, which averages about $8.50 per ton of annual production, means a return of something less than 4 percent.

The figures as quoted by the Secretary of the Treasury are in close agreement with the results of investigations by the Federal Trade Commission and the United States Coal Commission, which together extended over a period of 10 years from 1913 to the early part of 1923, and which showed an average profit of 32 cents a ton over a 10-year period which included the World War years. Such have been the earnings of an industry which a former Governor of the state upon more than one occasion termed "a hard-boiled monopoly." If hard boiled, it was probably due to being kept in hot water by the more than a dozen investigations to which it was subjected between 1914 and 1923.

But although the anthracite industry as a whole has not been one of rich gains to operating companies or their share holders, it has been the means of bringing prosperity to a group of communities located within the 500 square miles of area from which the anthracite, or hard coal, is extracted. Particularly has this been true in the first quarter of the present century, or from the settlement of the strike of 1902, which settlement had for a time a stabilizing effect on labor conditions and, indeed, on the industry generally, until the entirely unnecessary strike of 1925-26 administered a knock-out blow from which the victim has not yet entirely recovered.

INCLUDING the city of Harrisburg, which happens to be in one of the counties which produce a small quantity of anthracite, the population of the anthracite producing area numbers about 1,500,000 souls, about one-tenth of whom are employed in the mines or in and around the breakers of the anthracite companies. In a year of normal activity, such as 1924 (immediately preceding the strike) when the production was approximately 72,000,000 gross tons, there flows into the region through the payrolls of the anthracite mines a flood of $300,000,000 or more, drawn from other sections of the country—an average of more than $1,000,000 a day—and an average of about $200 a year for each of the 1,500,000 inhabitants. The anthracite region was not poverty-stricken in 1913, the year before the outbreak of the World War. In that year the commercial production of anthracite was 71,000,000 tons and the payroll was $113,320,000, or only a little more than a third of what it was in 1924, when the tonnage was less than a million tons larger.

In addition to the payroll, all of which goes directly into circulation through trade in the region or is deposited in the savings banks, the anthracite companies spend each year about $75,000,000 for supplies and the replacement of machinery, etc., most of which is paid to manufacturing industries of the region, for the anthracite companies with few exceptions believe in the encouragement of home industry and all the supplies and equipment that can be purchased in the region are so purchased.

Moreover, the anthracite producing companies are large contributors to the prosperity of the region through the municipal and county taxes, in which they are mulcted. The amounts of money paid in taxes have increased even more in proportion than have the wages. In 1913 the taxes paid by the anthracite producing companies amounted to a little more than $5,660,000. In 1924 the amount of local and county taxes paid by the anthracite companies had increased to something like $21,000,000, and in addition to this the state came along and, through the anthracite tonnage tax, exacted nearly $7,000,000 a year for its rakeoff.

All told, through the payrolls, the purchase of supplies, and the payment of local taxes, the amount of money distributed by the anthracite companies into the communities of the anthracite region amounts in a normal year to the tidy sum of about $400,000,000. Indirectly, also, the anthracite industry contributes to the prosperity of the region. The payrolls of such companies as the Vulcan Iron Works, the Hazard Wire Rope Works, the Cross Engineering Company, and others, whose products are consumed largely, (*Continued on page* 583)

* Executive Director, Anthracite Institute.

The Anthracite Industry *and* LEGISLATION

By John C. Haddock *

THE writer recently went to see a feminine relative, who has lived in the world a considerably longer time than he. It was after a peculiarly trying week in the anthracite industry and, fresh—or not so fresh—from a long train ride, he dropped into a chair saying, "Well, things certainly are confused with quite a lot of people making it hard for us." The reply was, "Well it's too bad, get tired but don't pity yourself." That is why the title of this article is what it is and not, in more modern and idiomatic English, "Socking the coal man." We have been investigated, regulated, taxed and legislated out of profits and markets, but at any rate we are not pitying ourselves, and better times we hope and feel are ahead.

For an accurate statistical and scholarly tabulation of facts relative to legislation and the coal industry, the author respectfully refers you to the files in his office or the even more extensive ones available in the corporate retreats of his friends and competitors, many of which were compiled by that exceptional statistician and good friend of our industry, E. W. Parker. In a brief history of past events such as this, only incidents of the greatest importance may be touched upon and, when figures are mentioned, they are used roundly or generally: .869492 percent for the average executives employed in 1927, 1928 and 1929 may be a good eye filling exposition of one's approximation of those satisfied with our legislative situation within the hard coal fields but "about 1 percent" reads a lot easier and is close enough. With these apologies and explanations, therefore, we will proceed with our delayed subject matter.

In a legislative survey of any industry, those laws designed with sincerity for the safeguarding of lives and the health protection of those within it deserve little complaint. Nothing is perfect, bromidic but worth remembering, so that it is well to view generously regulatory measures of this character even though we may not agree with some few of them. Application of the barrier pillar acts, the miners certificate restrictions pertaining to anthracite collieries and the like, have created serious injustices in some cases and intolerable situations in others; nevertheless on the average they are sound. Let us forget them and with them abuse of authority by one isolated mine inspector or official given enormous power when dozens, by virtue of this same legislation, are protecting the lives of workers and conserving property at salaries hardly commensurate with the degree of intelligence and training required by the self same laws.

LET us also pass lightly over the period of our gay nineties with railroad-owned mines, labor dissension, too few laws in some cases and too many in others. Let us pass lightly, but remember that the disorganized growth of the coal industry, the evils within it and the wails from its own people, coupled with those of the public, were the very things which left it the enemy of itself and the victim of nearly every politician with a bright idea, honest or selfish.

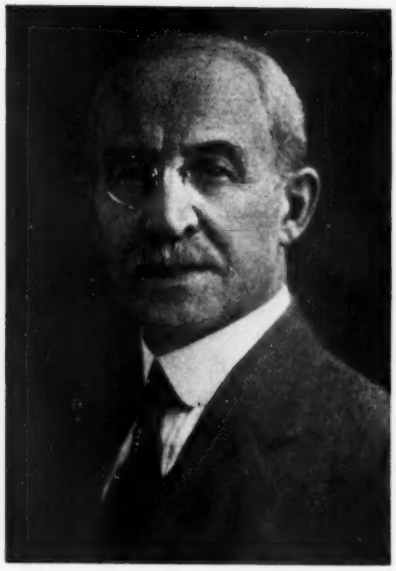
The sincere and justifiable efforts of Theodore Roosevelt in the strike of 1902 taught many of those in public life with less ability that coal was a political issue and from then on we find it becoming more and more a general football with four teams playing the industry, if one may continue the simile. The first was the aggregation of big letter men in Washington. Their cheering section was splendid but their teamwork bad, thank Heaven. Next we have the tate legislators; they rather played favorites and singled out the anthracite men as the victims of unnecessary roughness, while close behind trouped the local tax assessors, school boards and the like. Lastly we have the operators themselves, who, not content with these contests of vast importance, often got up scrub games among themselves and, by failure to adequately cooperate for common protection, suffered millions of dollars burden through adverse legislation.

And so back to Washington, with America entering the war; anthracite coal recognized as a geographical monopoly and a noticeable portion of the industry saying, "Yes it is, but what in the hell are you going to do about it?" Then began the palmy days when the only difference between a Yorkshire fox and an anthracite coal operator was that Reynard had four legs. Almost any week one could hear the frantic yelps of our major executives starting from the Federal Trade Commission or Dr. Garfield's offices with the deep throated bay of that worthy scholar (who was never anything else) leading the not always harmonious cry of the pack in our legislative halls. In those brave months our industry was regulated by bureaus, with a few swivel chairs, early American Low Boys and an infinite number of book cases thrown in. Under the well meant name of patriotism, we had market after market restricted and substitute after substitute introduced. With the same urge we were encouraged to institute development that is now causing dangerous overproduction and under the far flung banner of justice, special assistant attorneys and others used everything from the Lever Act to Barbara Fritchie's memory to withhold profits from many companies whose treasures are now dedicated to Mother Hubbard and whose bonds are oh-so-low.

What's the use of discussing this period in the lives of the anthracite operators? We made money to some extent, yes, temporarily, but the stage was being set for the future and sad as the writer may feel, we got and are now getting just what our policy from 1905 to 1925 entitled us to get, a large and all but permanent case of trouble.

When we leave Washington, however, and return to the capitol of Pennsylvania, we cannot feel that we are the victims of our own shortsightedness to any extent. Here we have a long record of legislative and quasi-legislative interference, the high points of which were the absurd and unjust (*Continued on page* 571)

* President, Haddock Mining Company.



ANTHRACITE Accident Prevention

By
***C. K. Gloman** **

IF YOU were going to paint a word picture of the anthracite coal region of northeastern Pennsylvania, in its relation to the important subject of anthracite accident prevention, you would have in mind, at least, a few of the many factors to illustrate the large scope of the industry, some of which we will enumerate.

The territory, scattered over some 484 square miles, is located in the counties of Lackawanna, Luzerne and Schuylkill, and projects into Carbon, Columbia, Northumberland, Dauphin, and Sullivan, and embracing over 100 different municipalities.

There are three major subdivisions of the field, which, with the percentage of tonnage and employees in each, are approximately as follows:

Wyoming region, or northern field, 58 percent, 55 miles long, 4 to 6 miles wide; Lehigh region, or middle field, 17 percent, is the smallest; and Schuylkill region, or southern field, 26 percent, 35 miles long, 4 to 5 miles wide.

The 180 separate collieries last year employed 153,000 men, of 26 different nationalities, and produced 66,000,000 gross tons, using 51,000,000 pounds of explosives.

Taking the industry as a whole, at least 75 percent, or 114,000, of the employes work underground, of which no less than 50,000 are contract miners and contract miners' laborers, who are the only piece workers at contract prices, and who work by twos, three, or fours in separated chambers or breasts in various sections of the mine.

Having in mind those important factors, the reader will, nevertheless, get only a faint idea of the tremendous problems that are involved in this important question of preventing accidents.

This subject of the prevention of accidents is, of course, present in all industries, but with added complications in the anthracite field, because of the fact that mining conditions in each of the seams or veins of coal, as they prevail throughout the field, differ in the same veins as they appear in the three different regions, i. e., in the Wyoming region mining is mostly in flat seams; in the Lehigh region strippin is general; while in the Schuylkill region mining is in seams pitching up to 75° and over; nevertheless, the accidents occurring in all of the fields to employes, during the course of mining, vary only in a slight degree as to the principal causes. The most reliable statistics show them to be, both as to the number of accidents and their severity, in the following order:

First, from falls of roofs, usually at working places; *second*, on haulage roads, cars, etc.; *third*, from explosives, premature blasts, etc.; *fourth*, from gas explosions.

These total about 90 percent with the other 10 percent scattered among numerous other causes.

It is gratifying to observe that within the past 15 years accidents from gas explosions have been reduced remarkably, dropping to fourth place from second, as a direct result of universal efforts by the coal companies, through the use of locked safety lamps, permissible explosives, battery firing, electric cap lamps, improved ventilation, closer inspection, and disciplining violators.

IT IS fair to say, as to the first three causes, that they continue in their gruesome supremacy, owing to the ever-present factors and the constantly changing conditions that develop in any working place in a mine, likely to occur in any period of the day's work, throughout this enormous area of underground operations, mining places, gangways, airways, tunnels, slopes, and shafts.

The anthracite operators are thoroughly interested in the promotion and development of accident preventative measures, and are prompt in adopting features that will advance the movement.

This was demonstrated in a report made early last year to the Anthracite Operators' Conference by a subcommittee on accident prevention and first aid. This committee, appointed by the conference, represented most of the companies, and, after making a survey, made a comprehensive report with suggestions and recommendations, and the report was forwarded to the executives of the companies.

It is the general practice among the companies throughout the region to maintain safety committees, usually composed of the division or colliery officials, and all of the bosses with prescribed duties, who meet at stated periods to discuss the causes of accidents that have occurred and to consider for adoption further preventative measures.

Improvement is being continually added in the matter of examining the working places and all other underground workings by the employes themselves and by the foremen, thereby discovering dangerous conditions, so that same may be (*Continued on page* 589)

* Purchasing agent and assistant to the general manager, The M. A. Hanna Co., Susquehanna Collieries Co., and The Lytle Coal Co., Wilkes-Barre, Pa.

MARKETING ANTHRACITE

Breaker, Weston Colliery, Shenandoah, Pa.

*By Alan C. Dodson **

SHALL a product, which has served the people of the eastern part of the United States as a domestic fuel for a hundred years, succumb to the inroads of substitutes, or shall it go on as it has this past century—the premier fuel for domestic heating?

The answer is: "It shall go on." The people of the coal regions, the miners, and the operators are of one mind that they are going to fight shoulder to shoulder in the battle against substitutes. Never has there been more wholehearted cooperation among the parties interested in an industry than there is today in anthracite.

The Anthracite Cooperative Association, formed as the outcome of the Mount Carmel Chamber of Commerce and composed of the public, the miners, and the operators, has done, and is doing, everything in its power to see that anthracite gets a fair deal. Its work in having the anthracite tax repealed was an outstanding accomplishment. It has since then done Trojan work in securing for anthracite a fair share of the Government's domestic fuel consumption. Where unfair regulations have been put into effect against anthracite, it has fought tooth and nail to have them withdraw and has been successful. It is today conducting an unremitting fight against the importation of Russian anthracite, introduced into this country by the Soviet Government and sold at less than cost. These are but a tithe of the good things that it is doing.

Alan C. Dodson

While the amount of badly prepared anthracite coal shipped to market in the past 10 years has been grossly exaggerated, today quality of anthracite is such that it is beyond reproach. There is every reason to feel that the public is today getting its anthracite as clean as modern machinery and methods can produce. Here is where the miner helps; he is sending as clean coal as he can to the surface.

The price of anthracite coal has been reduced so that the average return on all sizes is today from 30 to 35 cents a ton less than it was in 1924—this notwithstanding the fact that there has been no reduction in wage rates and the working time of the mines is many days less per year, causing, of course, a much higher cost.

How long the industry as a whole can sell its coal for a low figure and produce it at the present high cost, is a problem that only time will solve. In the meantime operators and retailers have but one slogan, which is "The public must be pleased."

Retailers are taking great care in their deliveries, they are cleaning furnaces, giving intelligent advice as to how to burn anthracite, and what 10 years ago was an industry which did not require sales effort, is now keenly alive to every modern method for soliciting trade. No longer can it be said that the dealers of anthracite are asleep at their desks. They are an intelligent, active, and energetic group of men, close to their customers, anxious to please and to convince that anthracite is the ideal domestic fuel.

The operators are going them one better: Refinements have been made in breaker practice so that the cleaning of coal is more standardized than ever. Uniform preparation of anthracite is assured. There is little or no fluctuation in the quality of the product which goes to market. Care is taken in dumping coal over the piers so that there is not too great a segregation of sizes or degradation. The coal, when it goes into the consumer's cellar, is in the same condition as it was when it left the breaker.

THERE is no domestic fuel that combines the qualities of anthracite: Its cleanliness, its ease of heater regulation, its safety in burning, its ease of storage—these and a dozen more reasons insure its future success.

The anthracite industry is ready to meet the changing problems that confront every industry. Its combustion engineers and its research organization are both part and parcel of the determination of anthracite to retain its markets against all substitutes.

* President, Weston Dodson & Company.

Getting the Product

By **Andrew K. Morris** *

IT IS a far cry from 1812 when Colonel Shoemaker hauled nine wagon loads of anthracite from near Pottsville to Philadelphia, Pa., to the present-day movement of hundreds of train loads to destinations far more numerous than the colors in the famous coat of Joseph. History seems to be lax in recording the time the nine wagons consumed in making the 90-odd-mile journey to the City of Brotherly Love, but under present-day railroad schedules the Philadelphians may enjoy the comfort of a cozy home heated with fresh mined anthracite in about the same time it probably took the colonel to harness his nine teams and load his wagons.

In 1870 canals were the favored means of transportation of anthracite, particularly to the seaboard, and the delivery to many cities consumed at least a month's time, compared with the fast coal trains that now bring the "King of Domestic Fuels" to the dealers in about the same number of hours as it formerly required days.

The entire load of the old canal boat was not equal to the capacity of the modern, self-clearing coal car, and one loaded canal boat was about the limit of the mule power, while a coal train at the present time of 80 to 100 cars is not an unusual sight. Since 1920 there has been an increase of 30 percent in the average number of cars per train. The 100-car coal train, however, is not new, as in 1844, on the Philadelphia and Reading, now the Reading Company, an 18-ton Baldwin locomotive hauled 100 cars loaded with 3.6 gross tons of anthracite each. The weight of the empty cars was 2.15 tons, making the weight of car and contents 5.75 tons and the gross weight of the train 5.75 gross tons. These trains had a 94-mile run at an average speed of 12 miles per hour. The average loading per car of the anthracite originating railroads is now 45.05 tons of 2,240 pounds. This is an increase of 15 percent since 1920.

All of the Pennsylvania anthracite originates in the northeastern part of the State of Pennsylvania, and the nine railroads serving the anthracite region transported from the mines an average of sixty-two and three-quarter million tons annually during the past four coal years ended March 31, 1927, to 1930, inclusive. The nine railroads shown in the order of the percentage of anthracite tonnage transported from the mines are:

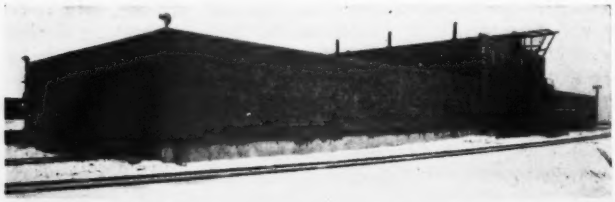
	Percent
Reading Company	19
Lehigh Valley R. R.	16
Delaware, Lackawanna & Western R. R.	16
Delaware & Hudson R. R. Corp.	13
Erie R. R.	10
Central R. R. of New Jersey	10
Pennsylvania R. R.	9
Lehigh & New England R. R.	5
New York, Ontario & Western Ry.	2
	100

The above-mentioned railroads have in service for the transportation of anthracite approximately 90,000 hopper bottom coal cars, the majority of which are of the self-clearing type. In addition, these railroads have thousands of open-top, flat-bottom cars, which can be used for coal loading when required. In past years when the anthracite tonnage to western points in the United States was 60 percent greater than it is today a considerable number of box cars were used for anthracite loading. The use of box cars for anthracite loading to the West was exceedingly profitable to the railroads, as it not only moved on a high freight rate but also provided a loaded haul for equipment, which otherwise is returned to the West empt for eastbound loading.

Prior to 1928 car shortages at the anthracite mines were frequent, severe, and costly to the mine workers, shippers, railroads, dealers, and consumers. Since 1928 car shortages have been practically eliminated.

The entire expense of loading railroad cars at anthracite breakers is borne by the shipper of the coal and, with the exception of at tidewater and Great Lake ports, the entire unloading expense is assumed by the consignee. At tidewater the unloading facilities are provided by the railroads. To tidewater the transportation rate from the mines is upon an "f. o. b. vessels" basis, while at the Great Lake ports the transportation rate, from the mines to the transshipping point for local delivery plus an unloading charge from the railroad cars to the vessels, is applicable. The modern unloading facilities at both tidewater and lake shipping points are of the car-dumper type which turns the car over, depositing the entire contents into a sloping pan or hopper from which the coal is loaded into the vessel through a tetescopic chute,

* Traffic commissioner, Anthracite Institute.



Pennsylvania Railroad thawing plant at Tidewater Coal Dumping Pier

Pennsylvania Railroad Modern Tidewater Coal Dumping Pier on Delaware River, at Greenwich, Port of Philadelphia, Pa. Thawing Plant in background

to Market

which can be lowered to the bottom of the vessel, preventing breakage and degradation of the coal. The accompanying illustrations show the present method of unloading anthracite from railroad cars to New York Harbor coal barges at the Erie Railroad coal piers at Edgewater, N. J.

To expedite the unloading of anthracite at the coal piers during severe winter weather, when the coal has become frozen in transit from the mines, facilities have been provided for thawing. The most recent thawing installation is that of the Pennsylvania Railroad at its new tidewater coal-dumping pier at Greenwich, in the southeastern part of the port of Philadelphia on the Delaware River. The Greenwich Pier thawing plant is 370 ft. long and 104 ft. wide and has a capacity of 60 cars. A uniform distribution of hot air in contact with all parts of the car thaws the coal in a short time.

Various types of vessels are used for the water transportation of anthracite from the tidewater piers in New York and Philadelphia Harbors. The coal for deliveries in New York Harbor is transported in barges ranging from 300 to 1,000 tons capacity, the average being about 500 tons. The latest barges put in service are from 800 to 1,000 tons capacity; the smaller barges being from 300 tons upward are being replaced with larger barges. The New England trade from New York Harbor piers is transported in barges ranging from 1,200 to 2,000 tons capacity, the average being about 1,500 tons. At Philadelphia the harbor barges range from 400 to 800 tons capacity, the average being close to 600 tons. The barges used in the New England trade from Philadelphia range from 1,000 to 2,800 tons, with an average capacity slightly exceeding 1,500 tons. The vessels carrying anthracite on the Great Lakes vary in capacity from 3,000 to 15,000 tons, with the major portion being of 5,000 to 11,000 tons capacity.

While the greatest proportion of anthracite used commercially is transported in railroad cars direct from the mines to final destination, a considerable tonnage is transported to tidewater for transshipment by vessels to points along the Atlantic seaboard and to lake ports for transshipment by vessels to localities on the Great Lakes and the St. Lawrence River. The coal borne via tidewater is largely consumed at or near by the port of unloading. Only 30 percent of the anthracite tonnage consumed in New England is transported rail and tide, whereas close to 70 percent of the bituminous coal tonnage for New England is transported rail, tide and rail. The difference between the combination of the rail, tide and rail anthracite rates and the all-rail rate to New England is not sufficient to cover degradation caused by the many handlings necessary in transferring the coal from cars to boats and again from boats to cars. Most of the coal transshipped via the Great Lakes is again reloaded into railroad cars and transported inland for considerable distances, as the all-rail rate is much higher and practically prohibitive. Using the railroad vernacular, the "rail-lake-and-rail" anthracite tonnage, which was always considered valuable and attractive traffic by the railroads, has decreased over 65 percent in the last 10 years, representing a considerable loss in coal

Five views of Erie Railroad New York Tidewater Anthracite Car Dumper at Edgewater, N. J.

Apron or pan in position to receive coal from car about to be elevated

Car in process of turning over, depositing coal in sloping pan

Pan and telescope loaded being lowered toward boat. Note closed gates at end of telescopic chute

Telescope about to enter bin of boat. Note gates are still closed

End of telescope at bottom of boat. Gates slowly opened, depositing coal without breakage

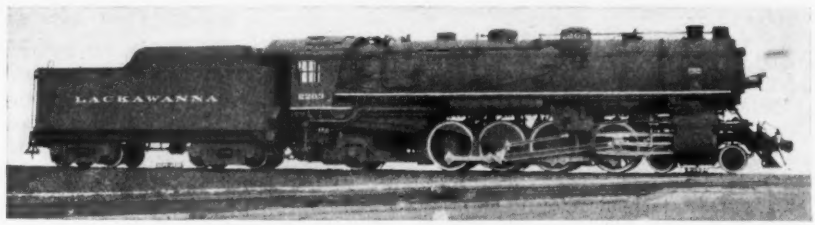
Type of locomotive used by "The Road of Anthracite" in 1900

revenue, particularly to the carriers reaching the lake ports.

It is not unusual for the anthracite market to require certain sizes with practically no immediate demand for other sizes. Anthracite breakers, which are the manufacturing plant of the industry, are constructed to prepare and load as many as nine different sizes, which are used for various domestic heating and industrial purposes in different characters of furnaces, burners and boilers. In the operation of a breaker provision must be made to load all sizes, as there are no facilities provided for the storage of any sizes in the breaker, and unless all sizes are loaded as prepared the loading facilities of the size or sizes for which there is no immediate market demand would become blocked, necessitating the discontinuance of operation of the entire breaker. In order to furnish the market with the sizes in demand and at the same time take care of the sizes not desired immediately, storage yards are provided in which the surplus sizes can be dumped into stock. These storage yards are, in most instances, established and operated by the shipper. The railroad transportation rates from the mines to anthracite-consuming territory include the privilege of storage in transit. The coal placed in storage is given the benefit of the same rate from the mines to the ultimate destination as a direct shipment from the mines and the rate applicable is the rate in effect when the coal moved from the mines to the storage yard. The territory to which coal from storage can be shipped is restricted to points in direct route from the mines, with additional charges for back-haul movements. The time limit on coal placed in storage as fixed by the Interstate Commerce Commission is two years, after which the benefit of the rate from the mines is denied and a combination of the local rates to and from the storage point is charged. The two-year time limit is applicable on storage coal ultimately consigned to all anthracite-consuming territory, except within the State of Pennsylvania, where the rate from mines to the ultimate destination is applicable, regardless of the time the coal has been stored.

A serious controversy of somewhat recent origin between the railroads and the shippers and consignees is the question of the adjustment of the discrepancies between the railroad way-bill weight of so-called wet-washed anthracite and the result of reweighing on railroad track scales at or en route to destination. There are different customs in vogue among the anthracite originating roads as to original weighings. At some collieries the coal is weighed almost immediately after it is loaded into the car, at other collieries the coal is hauled from a few miles to many miles, consuming from an hour to sometimes as much as twenty-four before weighing. This difference in time has a great bearing on the result of the weighing, as the coal traveling to the scales drains considerable water, depending on the length of time en route and the weather conditions. As a result of tests, the railroads have in effect percentage allowances to be applied on wet washed coal ranging about three-quarters of 1 percent to 1½ percent on egg size and from 1 percent to 6½ percent on rice and smaller sizes, that may be deducted from the original weighing. These percentage allowances are not uniform on all railroads, and in some instances the number of hours between the loading and weighing determines the percentage of allowance permitted.

An article of this character would be incomplete without some reference to the railroad transportation rates. The official textbook in anthracite transportation rates is the Interstate Commerce Commission's decision and order in Docket No. 4914, also known as "Rates for the Transportation of Anthracite Coal," 35 I. C. C. 220. This important case was pursuant to an order of the Commission, dated June 10, 1912. The case was decided July 15, 1915, and the reduced rates ordered by the commission became effective April 1, 1916. In April, 1918, all anthracite rates were increased 15 cents per ton; in June, 1918, increases ranging from 15 cents to 50 cents per ton were made, with an additional increase of 40 percent in August, 1920. In July, 1922, there was a 10 percent reduction in all anthracite rates. These adjustments made the rates approximately 65 percent higher than the rates in effect April 1, 1916. Since July, 1922, there have been reductions made at specific points as a result of complaints heard by the Interstate Commerce Commission. Other reductions, particularly to points in the State of New Jersey, are anticipated from recommendations made by examiners of the Commission.



Present-day type of locomotive used in the transportation of anthracite to market

Anthracite traffic to most of the initial anthracite railroads is the very backbone of their revenue and their prosperity rises and falls with the demand for anthracite. In 1923, when there was an exceptionally heavy movement of anthracite, following the suspension of mining from April 1 to September 1, 1922, it was estimated that a reduction of 10 percent in the anthracite rates would reduce the revenue of the anthracite railroads approximately $15,400,000. Anthracite, classified as a low-grade commodity produces for most of the anthracite railroads receipts per ton-mile exceeding the per ton-mile receipts on all other freight traffic.

The Anthracite Institute

Keeps the consuming public thoroughly posted on all developments in the anthracite industry, with special reference to the research work now conducted for the benefit of both domestic and commercial consumers.

Protects anthracite users against unfair practices.

Promotes the best interest of the anthracite industry and all engaged therein.

Acts as a clearing house on all information concerning the industry.

Its statistics show that, in a normal year anthracite employs 150,000 *men; pays* $300,000,000 *in wages; purchases* $75,000,000 *in supplies and replacement equipment.*

An old photograph of a group of slate pickers

INDUSTRIAL RELATIONS in the Anthracite Industries

By H. S. Gilbertson *

THE independence of the miner at his work, his isolation from other industrial workers, and the special hazards of his occupation have a great deal to do with his industrial point of view. These considerations should not be minimized; on the contrary, they must be given full weight in the formation of a labor policy.

From a management standpoint, perhaps the outstanding fact in mine labor management is the practical impossibility of exercising the kind of close supervision which is characteristic of factory organization. The very nature of the mining in a great part of the anthracite region especially, precludes frequent visitation during working hours. Miners usually work in pairs, rarely in groups. The introduction of gang methods and machine organization will provide exceptions to this rule, probably in increasing numbers in the bituminous industry. Over a large part of the anthracite industry machine and gang methods appear to be inapplicable, but when the flat, and particularly the thinner, seams are to be worked, some extension of such methods may be looked for.

The miner or coal cutter is, of course, not the only classification to be dealt with in the mines. The transportation end of the operation, which is a very big end, presents problems of its own, not unlike those of the greater units in the railroad business. Here, too, we are far removed from factory methods; and here, too, is the difficulty of maintaining close supervision.

Probably, however, the best approach to industrial relations in the anthracite industry is not the personal or the managerial but the economic one. Too much emphasis or significance can not be placed upon the fact that in anthracite mining the cost factor is of extreme importance. Now, the largest factor by far in the cost of mining is labor, running, as it does, in the neighborhood of 70 to 75 percent of total operating cost. This is an entirely different situation than that which prevails in a highly mechanized industry, or one in which high-priced raw materials largely enter, or the price of the finished article is capable of increase. A case of the latter type would be the automobile industry, where conveyors and heavy machinery do most of the work. On the other hand, the coal industry, both anthracite and bituminous, in many cases for considerably more than the major portion of time, is literally working for the miners. It is only when the market for coal is such as to justify something like full-time operation that such operations begin to work for their bondholders and stockholders. A fact in this connection, which may perhaps be often overlooked, is that a mining operation not only requires an enormous fixed capital but is also burdened with unusually high maintenance costs that go on whether the operation is working or not.

It is mainly on the basis of labor costs, which, in turn, are mightily affected by regularity and irregularity of employment, that anthracite prices are determined. An increase in labor costs of appreciable magnitude, occasioned by an increase in labor rates or any other cause, can rarely be absorbed, but must be passed on to the ultimate consumer in the form of increased prices. This is not because the coal producers will it so, but because of the very economic structure of the industry.

It is for these reasons, in part, that the coal industry may sometimes seem not to have displayed the same sort of generosity toward its labor which has sometimes been practiced by conspicuous figures in some other industries. There is not in this industry (or in most industries dealing in staple products) a margin of profit or of consumer indulgence into which the effects of such generosity might be absorbed. To appreciate these economic fundamentals is to understand the grounds for the resistant attitude of th leaders of the industry during the many controversies over industrial relations which have arisen in the last 25 or 30 years.

Prior to about 1900 the industry was destructively competitive, which means that every operator was constantly striving to get his share of business on a price basis. Naturally enough, this keen competition in the markets reflected back into operating policies and had a depressing effect upon wages. It is quite possible, also, that in a number of cases it led to abuses which were inspired by a desire or necessity for lower labor costs; that, with immediate objectives uppermost, expedients were adopted locally, by individual executives or companies, which probably would not have stood the test of a sound, constructive labor policy. But, in these earlier days, there was little or no such policy; in fact, no real unifying force in the industry which would insure the maintenance of fair prices and thereby stabilize wages and labor costs.

IT is not strange, as the situation is viewed historically, that effective recognition of the true significance of the competitive order came from the mine workers. Upon them competition left its impress in the intimate details of daily work and living. The economic status of the miner in 1902 was not nearly as bad as it is often painted. Movements as vigorous as that which has developed among the miners in the last 25 or 30 years do not spring from people who are downtrodden and without hope. But that status was far from as satisfactory as it might have been, as subsequent events have proven.

It was doubtless in this competitive order of things that strike methods and

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strike psychology originated. There were earlier strikes than that of 1887, but probably this one marked the beginning of the miners' recognition of the economic fundamentals of their situation. They seem to have thought that they had found the way to improved status through an affiliation with the Knights of Labor. The strike was a bitter one in parts of the region, but its strategy was defective. Evidently, also, the opportune moment had not arrived. The trend of prices at the time was against the chances of success. The leaders had yet to learn that labor movements usually have hard sledding on a falling price level.

THE later labor movement, which began to be organized in the late 90's, was a different story. By this time the price trend had turned upward and, as events proved, was to continue its upward course for a period of 20 years and more. In the meantime, also, the miners had gained experience in the strategy of striking. In 1900 a strike involving most of the anthracite field resulted in a 10 percent increase in wages and an appetite for more. The miners, now organized under the name of The United Mine Workers of America, deriving leadership and inspiration from the bituminous fields, renewed their struggle in 1902, with what agressiveness the world is well aware. After six months of conflict, President Roosevelt stepped in and instituted the first long series of commissions for the investigation of the industry. On the appointment of this commission, the miners went back to work with the understanding that whatever awards might be made to them by the commission were to be retroactive. After an exhaustive investigation, the miners were awarded a 10 percent increase in wages together with a bonus of 1 percent for each additional 5 cents in the tidewater price above $4.50.

Not only the miners and mine workers but the industry as a whole, and the community tributary to it, are indebted to the United Mine Workers for an improved economic status. It was this organization which furnished the only really solid basis of stabilization against the depressing influences of competition. The mine workers alone were sufficiently free from legal prohibitions to form a combination in restraint of wage cutting which, for the reasons stated above, would inevitably, in time of general business depression or specific industrial decline, have entailed disorderly price cutting and possible destruction for some of the weaker companies. This condition is the more clearly revealed in recent years, since a long series of Government investigations have effectively disposed of the "anthracite monopoly." And, it may be added, the value of stabilization through the miners' organization is of probably greater value to the industry today than in the days of rising prices when everybody made high wages and good profits.

Of more fundamental importance than the wage settlement of the Strike Commission was the establishment of the machinery of conciliation and arbitration, which have been functioning in the industry ever since 1903. This mechanism is simple enough, consisting, as it does, of a Board of Conciliation, comprised of three representatives of the miners and three representatives of the operators, to whom all questions arising under the joint agreement may be referred, after attempts at settlement in the individual collieries have failed. In the event of failure to make a settlement, the issue in question may be referred to an umpire, nominally appointed by the judge of the Federal district court, but actually by the two interested parties. The position of umpire was held for many years by Dr. Charles P. Neill, former United States Commissioner of Labor. He was succeeded by James A. Gorman, who had been secretary of the board since its inception.

Under the functioning of the Conciliation Board there have grown up by interpretation a number of established precedents, which might be termed the labor law of the industry. Frequently these precedents are something of an obstacle toward readjustments in the interest of greater efficiency of policy, but, on the other hand, they undoubtedly have exercised a stabilizing influence of great value.

The demands of the miners in 1902 had been resisted rather vigorously by the operators from motives which should be clear from the preceding discussion of economic factors. The operators were evidently and sincerely of the opinion that the public was not prepared to shoulder an increase in price.

During the long period of wage price and advances, through prewar, war and post-war periods, the unionization of the industry became gradually more complete. The fundamental secret of it lay in the fact that union leaders were able, time after time, to display to the miners and to the public the evidences of effective organization. It is important to note, however, that the greatest advances in wages and the improvements in working conditions came not as a result either of strikes or political intervention, notwithstanding the fact that resort has frequently been had to both these instrumentalities.

At the outstart, the operators were exempted from specific recognition of the union; in fact, the Anthracite Strike Commission expressly left open the door for the non-union man, undertook to protect him from discrimination and afforded him the use of the machinery of conciliation. The Union, however, was very successful, especially in the middle and southern fields, in drawing the main body of workers into its fold. But at no time has unionization been complete. It is for this reason, no doubt, that repeated efforts, repeatedly resisted, have been made to introduce the "check-off," which has for many years been a characteristic feature of the agreements in all the organized bituminous fields.

The year 1916 saw the inauguration of the basic eight-hour day.

FOR the one and only time in the history of the industry, arbitration was resorted to in 1920 and resulted in a general wage increase of 17 percent. At this time, also, the union was formally recognized. The peak of union power now seems to have been reached in the long strike of 1922, when the effect of what the operators feared in the beginning became evident. The strike was directly the outcome of tying up in a single organization the fortunes of the miners in the bituminous and anthracite industries. The strike was scarcely in any degree related to any anthracite industrial issue, but was an incident of a drive for general unionization of the coal industry. The immediate benefits to the miners were less than nil. In fact, it marked the beginning of a public reaction against the industry, which has been little short of disastrous for both miners and operators.

In the early fall of 1923 the agreement between the operators and the miners expired. There was a brief three weeks' strike; following which Governor Pinchot intervened and effected a settlement with a wage increase of 10 percent.

This happened while the industry was again in the process of investigation, this time at the hand of the United States Coal Commission.

The strike of 1925-26, following the expiration of the 1923 agreement, was, if anything, more ill-advised than its predecessor of 1922, coming as it did at a time when competitive fuels were awaiting an opportunity to step in and seize a share of the business of fuel service in the Northeastern States, which had come to be regarded as irrevocably committed to anthracite. The more acute phases of competition may be said to date from this six months' suspension of service. There was thus realized what the operators long had feared, viz, that at some juncture the acquiescence by the public in increased prices and continual interruptions and threats of interruption would cease.

All of which may seem unduly one-sided and over-critical of the policies and procedure of the workers' organization. However agreeable it might be to omit these unpleasantness, the fact remains that they mark the dramatic crisis of industrial relations in the industry. To pass them by without both mention and comment would be an unpardonable omission in a discussion of this kind. One can, however, express the confident hope that this phase of relationship, these methods of expressing the aspirations of the working man for better things, may have proven themselves more definitely characteristic of the period which lies behind than of the period to come. At any rate, it can be sensed, even though it may not be demonstrated, that the workers of the industry have been gaining a new conception of the part which they play and must play, individually and through their organization, in what is once more a highly competitive situation. The militant spirit, uppermost in the period of rising prices, emphasized and overemphasized the points of difference between management or ownership and men, and obscured the far more significant and fundamental interests in common.

LEGISLATION AND ANTHRACITE

(*From page 563*)

anthracite tonnage tax, signed by Governor Sproul, the various mine cave acts which virtually attempted to confiscate certain constitutional rights necessitating the closing down of some operations, and the semi-legal interference of Mr. and Mrs. Gifford Pinchot when the former was governor during one of our all too frequent strikes. While it is possible that our friends at Harrisburg could have burdened us more heavily in the decade prior to 1929, it is hard to see how they might have done so and left us solvent. It is, however, good to know that the order is changing, some laws have been declared unconstitutional, the repeal of the tonnage tax under Governor Fisher's signature is becoming operative and there is a keen realization on the part of those holding state office of the obvious fact, that the prosperity of a voter in a given territory rather depends on condition of the basic industry in that section.

And now we come to what was, until quite recently, one of the sorriest situations the coal operator had to face. He developed a mine and around it sprang up houses, while other mines brought other homes with added years improving the community, paving the streets, providing educational demands and the like. It frequently happened, therefore, that a coal company might own 80 percent or more of the taxable property in a given community but have little voice in elections. It was only natural that assessments on coal land should rise and marked local improvements, undertaken with what one may say gross extravagance, should result in many instances. Fortunately, a militant attitude on the part of certain of the larger companies, coupled with some excellent work by taxpayers' protective associations, is tending to correct a condition which at one time was well nigh intolerable.

All in all, we may, however, be said to have passed the worst days of our tribulations, in spite of the fact that it was only in March, 1930, that the Federal Trade Commission, sitting in solemn judgment on a company which had shown signs of having difficulty in withstanding competition rather than creating it, gravely ordered it to divest itself of certain production as contrary to the Clayton Act. All this with the poor defendant company controlling and shipping less than 2 percent of the annual tonnage of anthracite. Be it said for Commissioner Humphrey he dissented from this opinion, so that we may at least remember him among the increasing army of men in public life who are desirous of giving the anthracite industry a square deal.

After perusing the above complaints, don't get the impression that the undersigned in particular and the industry in general is disgusted, discouraged or too generally depressed. Just bear in mind that old Kentucky Colonel who was sitting under a tree early in the twentieth century and soliloquized thusly, "Well, Suh, the Yankees burned the homestead, the raiders run off our cattle, cotton was pooley off'n on from seventy to ninety-three, then come a fire in the barn and hawg cholera in nineteen one, but my daughter married tol'able well, my health's good and I've three barrels of bourbon in the cellar, so all and all, I'm right glad I'm a Colonel." We may grouse, we may rant, we may say we'd like to be chain store druggists, chiropractors, bank presidents or motion picture directors, but fundamentally we're glad we are anthracite operators, regardless of the fact that in most of our cellars are nothing but bound volumes of coal commission reports, fuel administrator regulations and proceedings of governmental investigation committees.

EARLY HISTORY OF ANTHRACITE

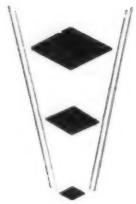
(*From page 561*)

And then there is the weather—about which Mark Twain said at one time: "Everybody complains about it, but nobody does anything about it." And for not less than four years the winters have been marked by temperatures considerably above normal, which have naturally reduced the consumption of domestic fuel and are reflected back to the mines in reduced production, more idle time, and consequently higher operating costs. And so it goes.

It might be well in closing to state that the taxing authorities have not been backward in exacting their pound of flesh. From 1913 to 1926 the taxes paid by the anthracite industry, and indirectly by the anthracite consumers, increased from $5,600,000 to $28,000,000, or 400 percent. The anthracite tonnage tax which was not in effect in 1913, constituted about one-fourth of the $28,000,000 paid in 1926. This tax is now, happily, going through the process of repeal at one-third the 1½ percent rate each year for three years.

In a brief luncheon talk at the meeting of the American Mining Congress last December, the writer paraphrased a once popular bromide with the statement that in the coal business "life is just one damn problem after another." Those that have been confronted in the past have been met and solved; those of the present day are in progress of solution; we can leave the future to take care of itself.

RESEARCH and new markets



By
R. V. Frost *

ANY industrial research program to be effective must be predicated on a thorough analysis of the trend of progress in that industry.

In formulating a research program on the marketable uses of anthracite an analysis of the trend of progress in the industry indicates two pronounced lines of procedure.

First, there is a steady drift toward the increasing use of the finer sizes of anthracite, buckwheat and rice. *Second*, the increasing use of oil and gas has created a demand for automatic heat in the mind of the consuming public.

With reference to the first, the drift toward the finer sizes had its inception in the development of the magazine feed boilers and furnaces, but the more recent improvement in the quality of the fine sizes through the adoption by the operating producers of improved methods of preparation and sizing, has been the means by which they have finally been established as domestic fuels. The drift is now so pronounced that in many ways it forms a serious embarrassment to the producing companies, for until there is a price adjustment upward the increased use of the fine sizes makes it increasingly difficult for the producer to realize a reasonable profit from his operations.

This is a situation that must be met by a forward-looking policy. To attempt to retard the movement toward the fine sizes by increased selling emphasis on the domestic sizes will not help the matter, rather it tends to give an impetus to competitive fuels.

There is no economic reason in domestic heating for a larger size of anthracite than pea. It has been conclusively demonstrated that pea size anthracite will meet any heating demand without change of heating equipment, that may now be obtained by the use of chestnut or stove anthracite. Furthermore, pea can be burned with considerably higher efficiency than can stove size anthracite. It is also capable of quicker and better control.

Now that anthracite producers are supplying buckwheat and rice sizes of such excellent quality, consumers in increasing numbers are learning this and find that they can use the finer sizes with excellent results in their old heating plants, where formerly only stove and chestnut had been burned. Some consumers use their old plants unaltered, others add a small blower and perhaps change the grates. At any rate they are finding that it is not necessary to incur a great expense to enable them to obtain greater heating satisfaction at less operating expense. It is among consumers of this class that the change over from domestic to small sizes will prove most disconcerting to the anthracite producer. Whereas the transition from domestic to fine sizes through the installation of new heating equipment will be at a fairly uniform rate of change and operators can count upon at least 20 years before the change from this source can seriously affect the market for the domestic sizes, the change taking place among the consumers using old heating plants cannot be gauged, and should the idea on the value of the fine sizes be widely disseminated, it is possible that a movement akin to a stampede could develop in the course of a few months and the nature of the demand throughout the anthracite territory change completely in a single heating season.

This trend should, because of this possibility, be carefully watched that it may not come upon the industry while in an unprepared state. It can easily be conceived that such a revolution in demand might result disastrously to the welfare of the industry.

REGARDING the second phase of the trend, the present well developed demand for automatic heat implies several things. primarily it means that the householder wants to be liberated from the labor that he has always known to be a necessary part of the ceremony of attending the fires. To him it is irksome to be held down to a prescribed schedule of stoking fires night and morning for seven or eight months of the year. He does not want to be required to shift the draft every few hours to meet the exigencies of heating demand. In short, he is looking for a complete liberation from responsibility for his heating plant. If it can be made to run itself, that is what he wants. He wants to be able to leave home for a few days or a week in the dead of winter and upon his return to find a comfortably warmed home. With either oil or gas the householder can accomplish this ideal, with gas more perfectly than with oil, but with coal the ideal is far from an accomplishment—at least with the present available equipment. True the householder can, with a thermostat, secure a well modulated heat without watching the thermometer or without tinkering with the dampers, but at least once a day he has the fun of shoveling coal and every other day he must don overalls, shovel ashes from the heater and then lug a heavy ash can up the cellar stairs. This mental picture is so distressing to the average man that it has, in the main formed the basic selling argument for the marketing of both oil and gas burners.

This thought in a more elaborate form applies likewise to the large residence and the commercial building where extra labor to attend the fires is required during the heating season. With automatic heat this labor expense is saved, consequently it is accounted for in computing the relative cost of automatic heat by oil or gas as against hand fired coal and sad to relate this labor saving with automatic oil or gas turns the scales against coal.

While the coal industry is taking steps to overcome the lead of oil and gas in automatic features, up to the present the equipment available is so negligible that coal cannot by any stretch of the imagination be regarded as an automatic fuel. At least not yet. But to those in close touch with progress in the uses of coal they recognize in it automatic possibilities far surpassing those possessed by many other fuels.

* Frost Research Laboratory.

We often hear the conjecture that coal will some day pass out as a natural fuel, that eventually all fuels will be liquid or gaseous. One making such a statement forgets that there is always a solid residue of very high heat value resulting from the distillation of fuels, and even though all fuels may eventually be treated and the gaseous and liquid products separated we will still retain a considerable quantity of solid fuel from the process. Consequently we must count upon continuing to have a solid fuel to burn and must provide the equipment for burning it.

Our concern at present is not whether we will have the solid fuel to burn but how we can burn it to the best advantage.

The progress toward automatic burning of solid fuels has been much more rapid in bituminous than in anthracite, whereas in the burning of coke, there has been as yet no apparent progress. However, it is in the use of anthracite that there is the greatest possibility of reaching the ideal in automatic heat.

THE progress so far made in automatic heating has been in the development of the burner or in the method of feeding the fuel to the burner. Stoker application in the industrial field has been confined almost entirely to the burning of bituminous. Hence stoker development in the domestic field had its beginning in the application of ideas developed in bituminous stoking. Nearly all the progress in the automatic burning of anthracite has been through borrowed ideas from bituminous and there it has stopped.

The feeder for bituminous has been very well developed and possibly because of its success on that fuel it was thought that it could be applied with equal success to anthracite. But beyond the feeder there has been very little development. A feeder merely feeds the fuel to the fire. It does not convey the fuel and it does not clean the fire bed and remove the ashes. All bituminous stokers require manual attention in their performance, but if solid fuel is to be used automatically, provision must be made for the conveying of the fuel from storage to feeder, for the cleaning of the fuel bed and for the removal of the ash. In fact, the performance of a domestic stoker must be wholly and entirely automatic and free from all attention of any form whatever.

Anthracite has been burned perfectly in this way but as yet none of these super-automatic devices have been offered commercially on a large scale. Why they have not is rather of a puzzle. There have been splendid devices for the automatic burning of coal available for at least five years but capital in sufficient quantity to properly exploit them can not be procured.

The anthracite industry is in the peculiar position that its market is entirely at the mercy of another industry, an industry that does not occupy a reciprocal trade position. This other industry, that of heating, is not concerned about what fuel the public prefers; its only concern is to supply the equipment desired. For that reason it has no particular incentive to boost the sale of coal burners. It would of course sell coal burners as readily as gas or oil burners, but at present there is a feeling of uncertainty in the heating industry as to whether coal will continue to be used in its present form and so it is standing pat on its present coal-burning equipment. While the heating industry has within the past five years passed through one of the most remarkable trade revolutions ever experienced by any industry, the changes in methods of coal burning, with the exception of the few stokers developed, do not include any other in the last 50 years, than the magazine feed burners for fine sizes of coal and a slight deepening of the fire pots on the surface burning types.

With this situation staring us in the face why wonder that the anthracite industry finds its market gradually slipping? In 50 years the improvements in methods of coal burning have been so few that the great bulk of purchasers are buying today no better equipment than their grandfathers could buy.

What is the result? Today the owner of an office building who desires to burn anthracite because he believes it to be a cleaner and safer fuel has the option of installing 50-year old, hand-fired coal burning equipment requiring expensive labor to operate or else to install an oil burner or a bituminous stoking plant. It is a thousand to one shot that he will *not* use anthracite fuel.

Or it may be a new residence of 10 or more rooms. The owner may or may not employ a man about the place. He would like to use anthracite but if he does not employ a man, there is the possibility if he buys a surface burner, of his wife being obliged to shovel coal in the middle of the afternoon and if he buys a magazine feed burner or a stoker he will have the pleasure of shoveling coal and rustling an ash can upon his return home at night. Not a pleasant outlook. No wonder oil is cutting into anthracite production at the rate of 300,000 tons per year. Still the anthracite industry holds to the belief that a greater drive on the domestic sizes is its salvation. How can the anthracite industry look to the heating industry to furnish capital for the exploitation of automatic coal burning devices when there is so little apparent interest on the part of those most vitally affected by the lack of proper coal burning equipment?

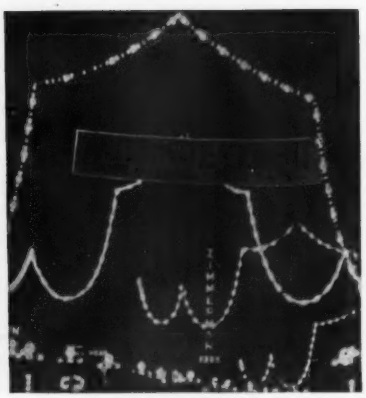
The anthracite market is so closely tied to the equipment market that the only way anthracite can profit is by a complete alliance between the two. Then if the equipment manufacturer does not furnish the desired equipment to burn anthracite as the public desires to burn it, the anthracite producer must supply the capital to market the equipment his product so vitally needs for its consumption.

THERE is one and only one clear cut policy open to the anthracite producer. Break away from his antiquated methods of marketing fuel. Realign his entire trade structure. Go out to sell the fine sizes because they are the better fuel, readjust his prices so that a dying size is not carrying the burden of profit and so that all sizes yield a reasonable profit. Change his mining and preparation methods so that the fine sizes can be supplied in adequate quantities and then get back of the equipment industry so that there will be the equipment available to burn his fuel by the automatic process the public demands.

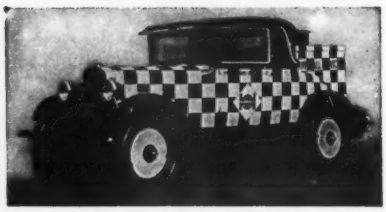
Then and then only will the cry cease about the disappearing anthracite demand. This policy is revolutionary, yes. But other industries have passed through equally as trying periods. Such a change will not come over night. It may not come in five years, but if it can be brought about within five years so much the better for the industry. The heating industry has passed through a whole series of trade revolutions in the past five years, and it is today in sounder condition than at the beginning of the period. The automobile, the steel, the gas, the street railway and numerous other industries have passed through periods that required complete reconstruction of their trade and manufacturing methods and have profited by the change. Why can not the anthracite industry do likewise?

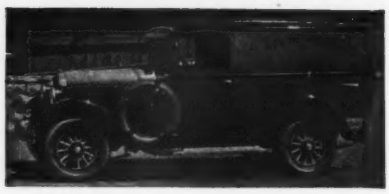
STRENGTH OF COKE MADE FROM GAS COALS

Work on the gas- and coke-making properties of American coals is now in progress at the Pittsburgh Experiment Station of the United States Bureau of Mines, in cooperation with the American Gas Association. Apparatus has been standardized for testing coal in 80 to 90 pound charges as to the yield and quality of gas and coke obtainable therefrom. Tests now complete for representative gas coals (unmixed with lower volatile coals) clearly show that cokes made at carbonization temperatures 500 to 900° centigrade are considerably stronger than those made at higher temperatures.



Anthracite advertised in the Mid-West





Representative retail coal merchants service trucks

Anthracite SERVICE

to the consumer

By C. A. Connell *

"MR. RETAIL Coal Merchant, this is Mr. Jones, 18 Market Street. I phoned to tell you that the coal which you delivered to me a few days ago is of very poor quality. Since its delivery I have been unable to properly heat my house. The coal will not burn except in a sluggish manner. It is evidently full of slate and bone, and I want it removed from my cellar."

"Mr. Jones, I am glad you called me, and I am immediately sending our service man to your home, who will investigate the matter and I assure you if you are not entirely satisfied by this afternoon, the coal will be replaced. We appreciate your patronage and will certainly perform our obligation to supply you with entirely satisfactory heat. Will it suit your convenience to have our man at your house within the next hour? . . . Thank you. Good-bye."

Within that hour a representative of the retail coal merchant had called at the house of the consumer, had examined the coal and the heating plant and found upon removing the smoke pipe from the chimney that a piece of chimney tile had been displaced and was wedged in the chimney a few feet above the smoke pipe entrance, where it blocked off three-fourths of the area of the chimney, thereby correspondingly reducing its ability to produce draft. The tile was replaced and the smoke pipe properly reinstalled and cemented into place. Immediately a stronger draft was secured, and the service man from the coal company waited for a sufficient time to make certain that the fire responded properly and that the consumer received a full explanation of the reason for his lack of heat. A few days later the consumer again telephoned to the retail coal merchant to advise him that the heater was working better than it had ever worked before, and apologized for his conclusion that the coal was of inferior quality, while thanking the retailer for the efficiency of his service.

The incident described above is typical of hundreds of cases which now occur daily in the retail merchandising of anthracite and gives proof of the industry's realization that today the coal merchant is not merely selling coal, but is engaged in the more complicated business of selling "heat." It is true that the consumer simply orders a ton of coal, but he expects to receive from the retail coal merchant the equivalent amount of comfortable and satisfactory "heat." Several years ago the anthracite operators recognized the transition from marketing "coal" to marketing "heat" and, through Anthracite Coal Service, an organization of combustion engineers maintained by the Anthracite Institute, they have provided their retail dealers with the training which is required to place them in a position to sell "heat," as exemplified by the incident described above.

Between 80 to 100 engineers of Anthracite Coal Service are located in 30 cities in the triangle formed by drawing a line from Minneapolis and St. Paul through Chicago, Toronto, Montreal, to Portland, Me., on the north, and to Washington on the south. From these cities the Coal Service engineers cover practically the entire anthracite-consuming territory, and to date 3,092 employes of 1,965 retail coal merchants in 121 cities and towns have completed the Anthracite Coal Service course of instruction in the fundamentals of heating engineering.

The instruction is given to organized classes, where groups of retail coal merchants' employes are assembled and hear lectures based upon a textbook written for that purpose by the Anthracite Coal Service. They are taught the fundamentals of heating engineering which permit them to analyze the heating plants of their customers and correct any difficulties, so that their customers may be assured of the heating comfort which can and should result from operation on anthracite but which is, in many instances, not secured due to faulty equipment, faulty firing methods, or both. In this connection, an analysis of 1,981 complaints taken at random, where in each case the quality of anthracite was stated by consumer to be responsible for unsatisfactory heating results, uncovered the following actual causes which were remedied:

	Percent
Faulty equipment	67
Improper firing	32 plus
Poor coal	1 minus
	100

* General Manager, Anthracite Coal Service.

The lectures also cover comparisons between anthracite and competitive fuels and provide proven arguments which the retail coal merchant may properly use to convince an undecided consumer of the superior merit of anthracite.

Supplementing the lectures, the engineers of Anthracite Coal Service accompany the retail coal companies' representatives to the homes of anthracite consumers which act as laboratories for practical demonstrations of the subject matter discussed at the meetings, and also give the consumer the benefit of expert advice in the maintenance and operation of his heating plant.

Not only are retail coal merchants in general thus serving their customers by removing causes of trouble after they have developed, but a large and ever-increasing number of them have found that heating service is so beneficial to the consumer and to themselves that they now make it a practice to have their trained representatives systematically call upon every customer on their books, at least once a year, to make a careful survey of the heating plant and to make certain that the plant is in such condition that complaints are forestalled.

The retail coal merchants following such a program retain in their files a complete record of the customer's heating plant and of the size or sizes of anthracite which are best adapted to his requirements. At the time of the service call, the consumer is also instructed in approved firing methods, etc., and a card prepared by Anthracite Coal Service, describing the care and firing of boilers, is tacked in a convenient place in the cellar where it may be easily read.

It is, of course, impossible to provide a complete engineering education in any short course of instruction, and cases are encountered following the training where problems are too technical for the retailer's representative to solve. In those cases he needs only to call upon the nearest engineer of Anthracite Coal Service, who gladly furnishes the technical engineering aid required. Thus the retailer, through training by Anthracite Coal Service engineers and continued consultation with them, is in the desirable position of being able to guarantee complete heating satisfaction with every ton of anthracite which he delivers.

One feature of the service departments of more than 700 retail coal merchants is the use of portable vacuum cleaning outfits to remove ash deposits from surfaces of boilers, flues, and smoke pipes, thus increasing the efficiency of heat transfer and the utility of anthracite.

It is also a fact that industrial consumers and consumers of anthracite in the large heating or power plants of department stores, office buildings, etc., present problems to the retail coal merchant which only a qualified combustion engineer can solve. In those cases, again the engineers of Anthracite Coal Service are available whether the question may be the determination of the advisability of using anthracite or a competitive fuel or whether the question may be one of operation with anthracite. Among such problems, slagging tubes, baffle designs, air distribution in wind boxes of stokers, boiler and engine sizes, etc., are all analyzed and constructively reported on by the engineers of Anthracite Coal Service to the retailers, or owners or managers of large boiler plants.

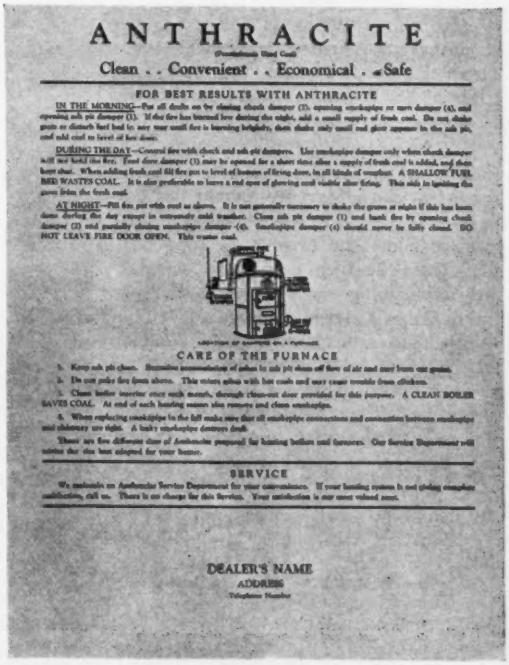
The Anthracite Coal Service also places their services at the command of architects and designing engineers in the selection of fuel and to provide information concerning equipment to burn and handle anthracite and to handle ash.

A manual on anthracite, including technical and nontechnical discussions of the method of using anthracite under varying conditions and of the comparative value of anthracite with other fuels, has been prepared especially for architects, and 10,000 copies have been distributed to architects and designing engineers within the anthracite-consuming territory.

The Anthracite Coal Service continually provide all retail coal merchants selling anthracite with sales helps, including authoritative proofs and arguments, which they can use, on the superiority of anthracite over competing fuels, descriptions of interesting service calls, ideas for window displays, etc. In this connection, 14,000 copies of a publication, "The Anthracite Salesman," containing such sales and service aids, are prepared and distributed to retail coal merchants each month. Pamphlets and envelope stuffers covering various phases of the uses of

(*Continued on page* 583)

Retailer's service man cleaning customer's boiler



ANTHRACITE

Clean . . Convenient . . Economical . . Safe

FOR BEST RESULTS WITH ANTHRACITE

IN THE MORNING—Put all drafts on by closing check damper (3), opening smokepipe or vent damper (4), and opening ash pit damper (1). If the fire has burned low during the night, add a small supply of fresh coal. Do not shake grate or disturb fuel bed to save your small fire is burning brightly, then shake only small red glow appears in the ash pit, and add coal to level of hot coals.

DURING THE DAY—Control fire with check and ash pit dampers. Use smokepipe damper only when check damper is all way back the fire. Feed door damper (2) may be opened for a short time after a supply of fresh coal is added, and then kept shut. When adding fresh coal fill fire pot to level of bottom of firing door, to all kinds of overfeed. A SHALLOW FUEL BED WASTES COAL. It is also profitable to leave a red spot of glowing coal visible after firing. This aids in igniting the gases from the fresh coal.

AT NIGHT—Fill fire pot with coal as above. It is not generally necessary to shake the grates at night if this has been done during the day except in extremely cold weather. Close ash pit damper (1) and bank fire by opening check damper (2) and partially closing smokepipe damper (4). Smokepipe damper (4) should never be fully closed. DO NOT LEAVE FIRE DOOR OPEN. This wastes coal.

CARE OF THE FURNACE

1. Keep ash pit clean. Excessive accumulation of ashes in ash pit shuts off flow of air and may burn out grates.
2. Do not poke fire from above. This enters ashes with hot coals and may cause trouble from clinkers.
3. Clean boiler interior once each month, through clean-out door provided for this purpose. A CLEAN BOILER SAVES COAL. At end of each heating season also remove and clean smokepipe.
4. When replacing smokepipe in the fall make sure that all smokepipe connections and connection between smokepipe and chimney are tight. A leaky smokepipe destroys draft.

There are five different sizes of Anthracite prepared for heating boilers and furnaces. Our Service Department will advise the size best adapted for your boiler.

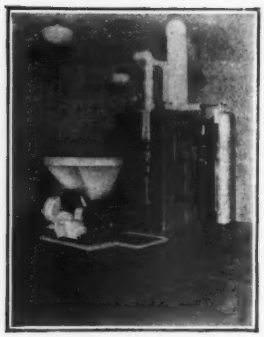
SERVICE

We maintain an Anthracite Service Department for your convenience. If your heating system is not giving complete satisfaction, call us. There is no charge for this Service. Your satisfaction is our most valued asset.

DEALER'S NAME
ADDRESS
Telephone Number

Firing instruction card (11 x 14 inches) being distributed by retailers

Anthracite exhibited at Fond du Lac, Wis.



The Motor Stoker

The PRACTICABILITY of the Small Domestic Stoker

By **Allen J. Johnson** *

THE rapid development of all types of automatic equipment has resulted in a demand for a degree of convenience that can not be measured in terms of direct monetary savings. The electric refrigerator is, for example, valued for considerations other than its low cost of operation; similarly, mechanical anthracite burning equipment that saves trips to the cellar increases the utility of the heating system far above the actual gain in efficiency.

The effectiveness of thermostatic devices in reducing the amount of manual regulation of the furnace should not be under-estimated. However, there is a strong demand for even more complete relief from heating care than merely that provided by the automatic control of the fire. A large number of home owners have even become so insistent that their heat be supplied automatically that they are displaying a willingness to disregard cost and other vital items in order to purchase that equipment which seems to them to offer the nearest solution of the problem of furnace attention.

By using the small sizes of anthracite in conjunction with automatic stokers there is, however, no necessity for a sacrifice of economy, cleanliness, or safety. Several equipment manufacturers, cognizant of this condition, are marketing anthracite burning stokers for home heating.

* Combustion Engineer, Anthracite Coal Service.

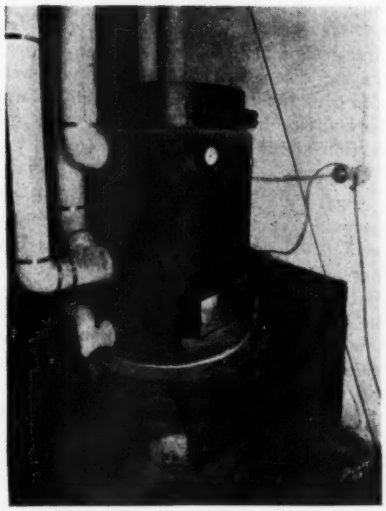
The Electric Furnace Man

Principles of Stoker Design

Three principles of design have been incorporated in domestic stokers—under-feed, with combustion taking place in tuyeres; overfeed, in which anthracite is automatically thrown on the fire; and side feed, in which coal is fed either at the periphery of a revolving grate or at the end of a traveling grate.

Attractive bungalows of this type are materially enlarged by the utilization of basement space

Two of the most popular domestic anthracite stokers—the electric furnace man and the motor stoker—are operated on the underfeed principle. Although, in the power field, underfeed is considered practical only in connection with the combustion of bituminous coal, this is not the case in domestic installations, where ratings are low and the necessity for extreme efficiencies does not prevail. The principle has, in fact, been adapted so successfully to anthracite that these stokers are operating satisfactorily in thousands of homes.



The Wedge Mechanical Furnace

The Wedge Mechanical Furnace, a more recent addition to the field of anthracite equipment, embodies a revolving grate onto which a measured supply of coal is fed and then pushed toward an ash hole in the center by the combined action of the fresh coal and a spiral dead plate at the circumference of the grate. This stoker includes a special boiler as an integral part of the installation.

Several overfeed stokers have also been developed, at least one of which—the Auto Coala—is being actively marketed. This stoker includes an elevated magazine from which buckwheat or pea anthracite is fed to a thermostatically controlled distributor or flipper which, by reason of its irregular surface and relatively high speed, distributes the fuel evenly over the surface of the grate.

Economy of Domestic Stokers

The principal appeal of domestic stokers, from an economy standpoint, lies in their ability to use buckwheat and, in a number of cases, even rice anthracite.

On a basis of an annual fuel consumption of 10 tons of hard coal per heating season, a fair comparison between the

cost of heating a home with an anthracite stoker and an oil burner follows:

	Anthracite	Oil
Cost of fuel per ton or gal.	$8.00	$0.08½
Amount of fuel per season	10	1,700
Annual fuel cost	$80.00	$144.50
Interest on investment at 6%*	36.00	48.00
Depreciation at 10%*	60.00	80.00
Gas for pilot	.....	10.00
Electricity	30.00	30.00
	$206.00	$312.50
		206.00
Saving through the use of coal		$106.50

* Based upon average oil burner costs of $800 and fully equipped stoker costs of $600, and assuming the life of both to be 10 years.

It is thus apparent that a home can be heated with anthracite with a saving of approximately one-third of the expense of heating with oil, a fact that is in itself a strong sales argument for the use of coal.

Noiselessness of Automatic Stokers

There are, moreover, other reasons for the use of hard coal, which in some respects are as important as the saving in the cost of operation. The relative noiselessness of anthracite equipment as compared with oil is, for example, illustrative of this point.

While it would seem, after a casual inspection, that any motor-driven furnace auxiliary would be equally as noisy, this is not necessarily the case for several reasons, since the roar of the oil flame, the sustained sound due to the vibration of various parts of the equipment, the drumming of half filled oil tanks, and the humming of high-speed oil pumps are all oil-burner noises which have no counterpart in anthracite equipment.

Ash Removal Facilitated

An important feature of the outstanding stokers is their provision for removing ashes from the furnace and depositing them in easily accessible sealed cans for periodical removal.

The Electric Furnace Man includes a screw conveyor which brings the ashes to the front of the furnace, where they are automatically deposited in a covered can. In this instance the can is above the floor, where it may be readily removed and replaced with an empty can. The Motor Stokor also provides for dustless ash removal by ejecting the ashes into a receptacle located in a covered pit under the cellar floor. The Wedge Furnace includes an ingenious and extremely simple device which automatically fills two large cans in turn. The subsequent removal of the ash cans from a covered pit is easily accomplished by means of an inexpensive chain hoist suspended from a small mono-rail carrier, which can be constructed to convey the ashes to any location convenient for final disposition.

The labor and attention saved by the incorporation of ash-removing features as a part of the design of the domestic stoker is apparent. Their utility from a standpoint of cleanliness also carries a particular appeal to the modern housewife.

Two plans for making the basement an "extra floor"

Gravity Feed From Bin to Stoker

A further feature of automatic stokers is the admirable degree with which they are adapted to the use of overhead hoppers from which coal, as delivered by the retailer, is fed by gravity to the fuel bed. By thus eliminating the necessity for either fuel or ash handling, the stoker can be depended upon to keep the house comfortable for long periods of time without attention of any kind. That such a plan is practical rather than merely theoretical has been demonstrated in a Rosemont, Pa., home, where the owner desired to leave his home unoccupied for several days at a time during which absolutely no attention could be given to the fires. A stoker has been installed and is operating to the perfect satisfaction of the owner, who now absents himself with the assurance that his home will not be subjected to a fire hazard and will be comfortable when he returns.

Anthracite in the Modernized Cellar

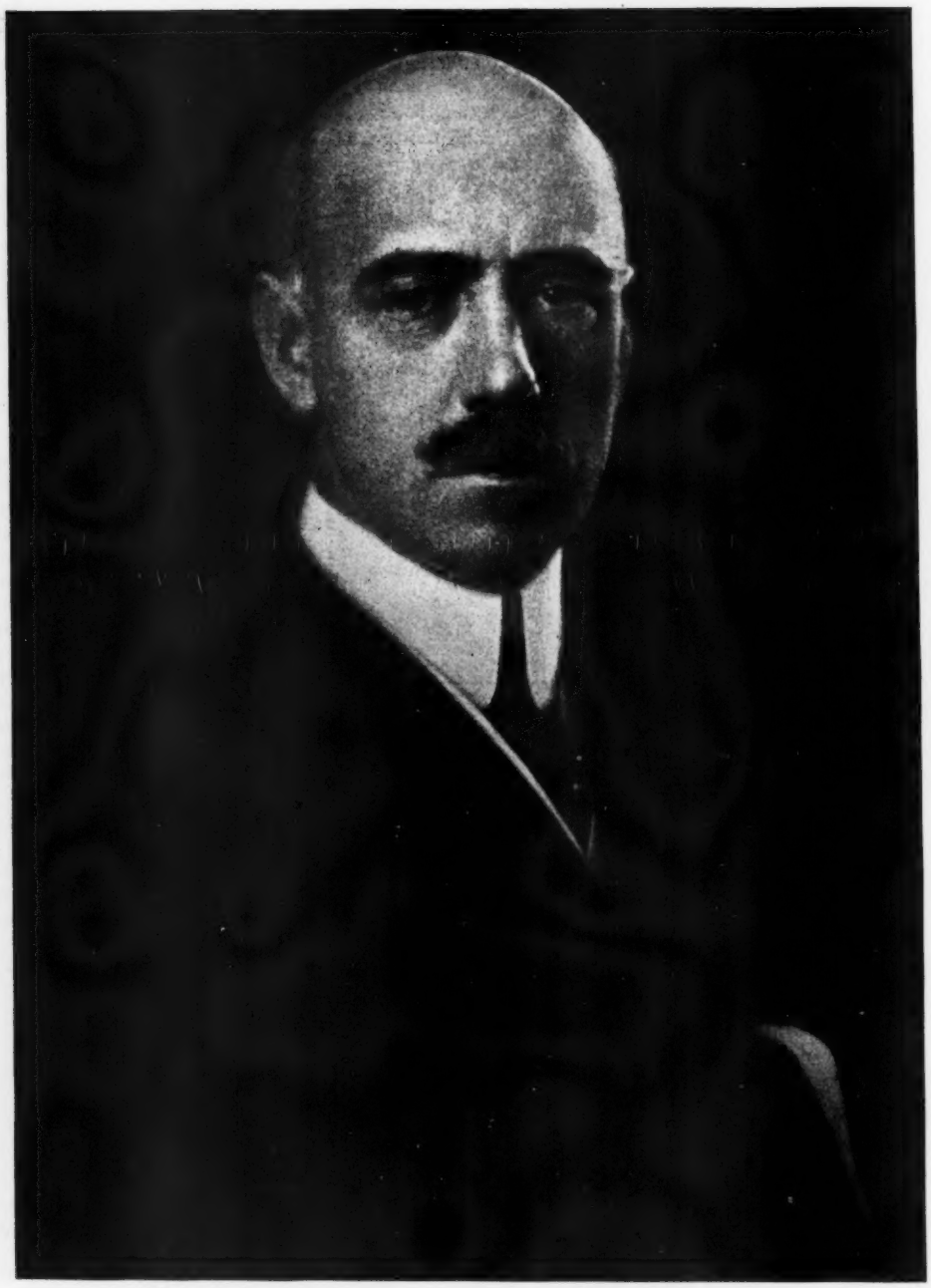
The former objections to the use of cellars for living quarters and recreation rooms have been disproven since the advent of automatic heating equipment. There is, in fact, a strong tendency to utilize the basement for purposes for which it was formerly considered necessary to add an extra floor. Although the segregation of the heater room from the remainder of the cellar has been applied to the larger sizes of anthracite, it is more desirable in smaller homes, and also often less expensive, to provide a fully automatic system including an overhead storage bin and anthracite stoker, and then locating the living quarters in the same room as the heating plant. Such cellars may be completed with casement windows (with exterior light wells if considered desirable), ample electric outlets, concrete, linoleum or wood floors, and wallboard or plaster sidewalls and ceilings as simple or elaborate as may be desired. The result is added space in the home without a proportionately increased expense.

Automatic anthracite stokers lend selves admirably to this modern trend in architecture since, as has been previously explained, hard coal alone possesses the advantage of economy and noiselessness, and absolute safety, while retaining desirable features necessary for adapting it to mechanical control.

Quality of Fuel Contributes to Success

A consideration of automatic equipment should not lose sight of the fact that the successful operation of mechanical firing devices has, to a large extent, been made possible as the result of the present uniformity of size and quality of anthracite together with a realization on the part of both the (*Continued on page* 583)

The Lehigh



Samuel D. Warriner, Chairman of the Board, Lehigh Navigation Coal Company

IN THE measure of the component parts of any industry there are certain statistics which determine the position of any part or company. Applying this rule to the Lehigh Navigation Coal Company, it ranks among the great anthracite coal producers. On its 21,000 acres in Carbon and Schuylkill Counties and its leased lands in Luzerne County it operates eight large collieries, capable of mining and preparing each year about four and one-half million tons of coal. This is about one-eighteenth of the total anthracite production. In accomplishing this a vast engineering development is required, the extent of which can be gathered from the fact that there are some 150 miles of active gangways. Rock tunnels, airways, and chutes are driven annually to the extent of some 100,000 ft. In addition to these underground operations there are large strippings, which in a normal year remove two and one-half million cubic yards of overburden and 625,000 tons of coal.

Preparation of the coal to meet the modern exaction of the anthracite market is a problem of mammoth proportions, for with every ton of coal that is extracted from the mines three-fourths of a ton of refuse is also borne to the breakers to be separated and removed by a process which rivals in thoroughness that which is employed in the preparation of metal ores. Two and one-half million tons of refuse are piled up each year. Disposal room in the comparatively narrow Panther Creek Valley is a pressing problem and gives rise to the unsightly culm banks, evident in many mining localities, but larger in this valley than elsewhere because of the condition encountered in the mining operation and the necessity of removing so much refuse in order to get at the coal.

But mere size of operation is not the true measure of importance. What the company feels that it may point to with pride is the persistence of the pioneering spirit. Through this, largely, it has mastered an extremely complicated mining situation. The peculiar characteristics of the coal in the lower anthracite region, which causes some 50 percent of the coal to break up into the smaller unprofitable sizes, would tax the resources of any management to keep the cost of production within the total revenue.

The pioneering spirit of the company is the direct and valued heritage of its founder, Josiah White, a Philadelphia Quaker. It was he who first visioned the broad possibilities of the industry and took the first steps toward the mining of anthracite on a practical and successful basis. He was much more than a coal man, however, for to him anthracite was the basis of a great economic development within that portion of Pennsylvania comprised in the Lehigh Valley. He saw anthracite not as a single commodity, but as the foundation of industries. He it was who gathered up the pieces of an earlier adventure following the discovery of coal at Summit Hill in 1791, and founded the Lehigh Coal and Navigation Company in 1820. This was the first of the anthracite companies and the owner of the present operating company — Lehigh Navigation Coal Company.

Navigation Coal Company

By **J. B. Warriner**

J. B. Warriner, President, The Lehigh Navigation Coal Company

White was a pioneer in every sense that the world implies. His contributions to land and water transportation were equally as great as to the coal industry. After accumulating a comfortable fortune for his day, he turned his attention to navigation problems. The first boatload of coal that proceeded down the Lehigh was brought to his attention and he purchased a ton for $21, experimenting with it in a nail factory which he was then operating in partnership with Erskine Hazzard. About to give up the experiment as useless, one of the workmen closed the door of the furnace and started home. After going a considerable distance he discovered he had forgotten his coat, and upon return discovered that the fire in the furnace was red hot. It was mere chance, perhaps, that led to this discovery, but it was far-sighted vision and faith in its future possibilities that led White to continue. After a tour of exploration of the Lehigh River and the mines at Summit Hill, he returned filled with enthusiasm and a sublime faith in the practicability of his ideas.

The Lehigh Navigation Company was organized and financed in the face of discouragements, rebuffs, and flat refusals, which only a man of his sterling character and perseverance could surmount. Finally he succeeded in raising the necessary money to commence the work, and here his great economic genius was given full play.

The completion of the Lehigh Canal was not perhaps the greatest of his difficulties. When it was completed from White Haven to Easton, and in operation some years, a great flood in 1842 wiped out practically all the work on the canal between White Haven and Mauch Chunk, and it was only rebuilt with considerable difficulties and an expenditure of almost $1,000,000. In 1863 another and even more disastrous flood occurred, the result of which settled definitely in the minds of the managers that the building of railroads was essential. Canals had passed the peak of their importance as a means of inland transportation, the Lehigh showing its greatest tonnage for all time in 1855.

But the company was a railroad builder from the very start. The first railroad to be built was a gravity road from the mines at Summit Hill to Mauch Chunk. It was completed in May, 1827, and is still in use, though for sight-seeing purposes only. White being far-visioned saw the possibilities of getting to market the product from the Susquehanna Valley and points farther west. Before doing this it was necessary to devise means of transportation over the mountains from Wilkes-Barre to White Haven. This he accomplished by means of the Ashley Planes, which are also still in operation.

The canal was gradually replaced by sections of railroad, which finally were united into the Lehigh & Susquehanna Division of the Central Railroad of New Jersey. At a later date there was pieced together what now is the Lehigh and New England Railway, which is one of the principal outlets of the anthracite region into the eastern New York and New England markets.

The company, due to the peculiar con-

Josiah White

Erskine Hazzard

Founders of the Lehigh Navigation Coal Company

tour of the coal veins on its property, became a pioneer in mining and developing a system for extracting the coal from heavy pitching veins. In the course of this development it drove the first mining tunnel (Hacklebernie) driven in the United States.

The company was a pioneer in the development of a preparation system. Some of the earliest processes of wet cleaning were developed by the company's employes and officials.

The pioneer spirit manifested itself again in the generation of electrical energy at the source of fuel. Due to heavy pitching veins the percentage of domestic sizes recovered in the company's operations is not so large as that of other companies in the anthracite region, where flat veins predominate. A large amount of the smaller sized fuel, for which there was no market, was being dumped as refuse. In order to conserve this coal a power plant designed to burn small sizes was established at Hauto in 1911. The plant has since become part of the extensive generating system of the Pennsylvania Power & Light Company.

The company (*Continued on page* 593)

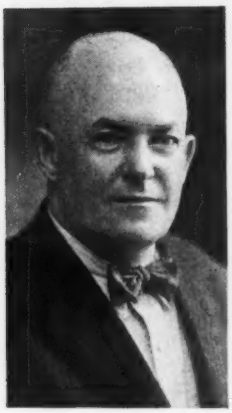
T. D. Thomas
Mine Inspector

A. G. Frank,
Mechanical Engineer

T. D. Lewis
General Superintendent of Lehigh Navigation Coal Company

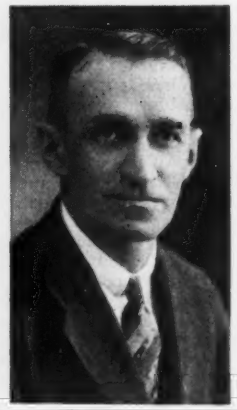
W. S. Rausch
Mining Engineer

R. E. Hobart
Mechanical Supt.



F. S. Riordan
Compensation Adjustor

H. S. Gilbertson
Director of Personnel



L. A. Levan
Assistant Mining Engineer

S. E. Thorne
Stripping Superintendent

J. S. Miller
Director of Research

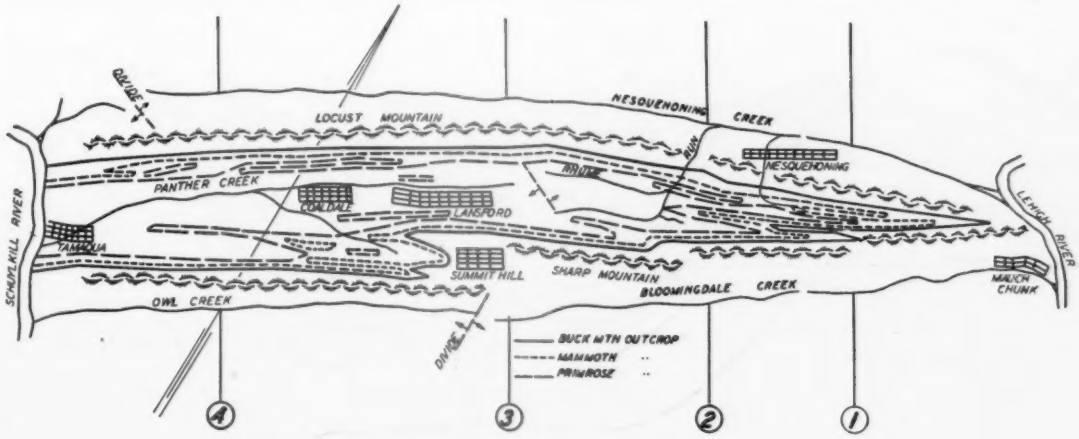
A. C. Neumuller
Forester

Dr. R. H. Kistler
Chief Surgeon

H. J. Seitzinger
Safety Engineer

F. R. Edwards
Storehouse Inspector

Lehigh Navigation Coal Company



MAP OF PANTHER CREEK COAL AREA

FIGURE 1

PANTHER VALLEY GEOLOGY

By

L. A. LeVan

ASSISTANT MINING ENGINEER

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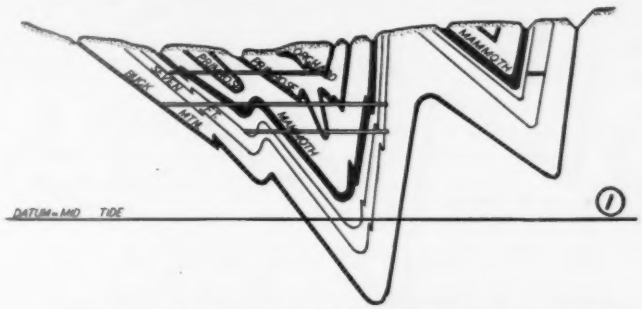
THE anthracite coal fields are located in northeastern Pennsylvania. They comprise four sections—Northern, Eastern Middle, Western Middle and Southern Fields. The various fields were formed primarily by subsidence; and secondarily by folding, caused by thrust forces from the South, acting in a general northwesternly direction, thus producing maximum disturbance in the Southern Field, particularly at its eastern extremity where is located the Panther Valley which contains the mines and collieries of the Lehigh Navigation Coal Company. Disturbance caused by these forces diminishes gradually towards the north and consequently only slight disturbance and distortions of veins exist in the Northern Field.

Subsidence occurred when the rock forming materials were quite plastic and soft as compared to that of the coal, happening at various intervals to permit the formation of the various beds of coal and the dividing strata of rock with fairly regular continuity throughout. Next, the measures were sharply folded by the secondary forces, thrown high in places and faulted; and if not faulted and broken, placed under severe strain. Finally, local folding and faulting occurred as nature's means to relieve the undue stress in the strata, and happening after the rock, etc., was well formed as is evidenced by the crushed condition of the coal veins and breaks in the rocks.

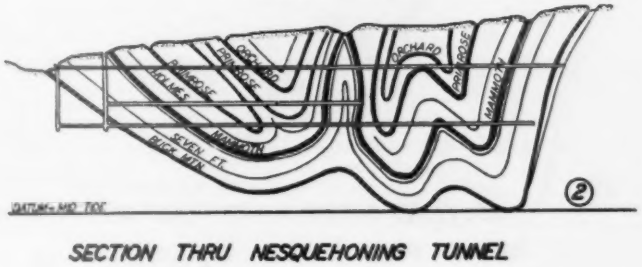
Panther Valley, approximately two miles at its greatest width, extends from Tamaqua, on the Schuylkill River, to Mauch Chunk, on the Lehigh River, a distance of nearly 14 miles, and is drained by tributaries of these rivers. The divide between the water sheds of the two rivers is at a midway point called Summit. Summit is two miles east of Lansford where are located the main offices of the Lehigh Navigation Coal Company. *Figure 1* is a map showing general surface features of the Panther Valley area, outlining the extent of the coal beds contained in it.

As stated previously, the valley is in the eastern extremity of the Southern Field where folding was most severe, consequently the strata are deeply inclined, ranging in pitch from 33° south dip on the north side to vertical and inverted dips on the south side. The coal measures are deepest and widest in the area between Lansford and Tamaqua. Rising gradually eastwardly from Lansford, they finally spoon and end in the east near Mauch Chunk. Folding has caused numerous anticlines and syn-



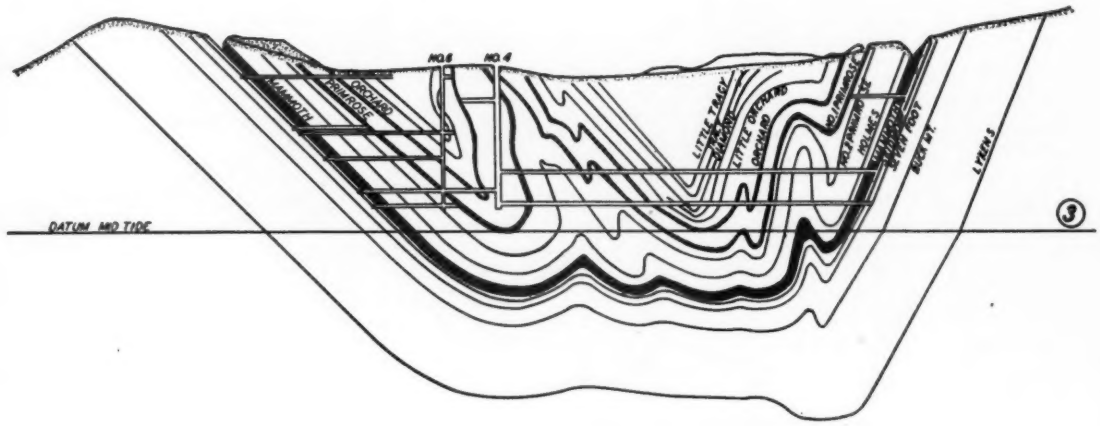
SECTION 2600' EAST OF NESQUEHONING TUNNEL

FIGURE 2



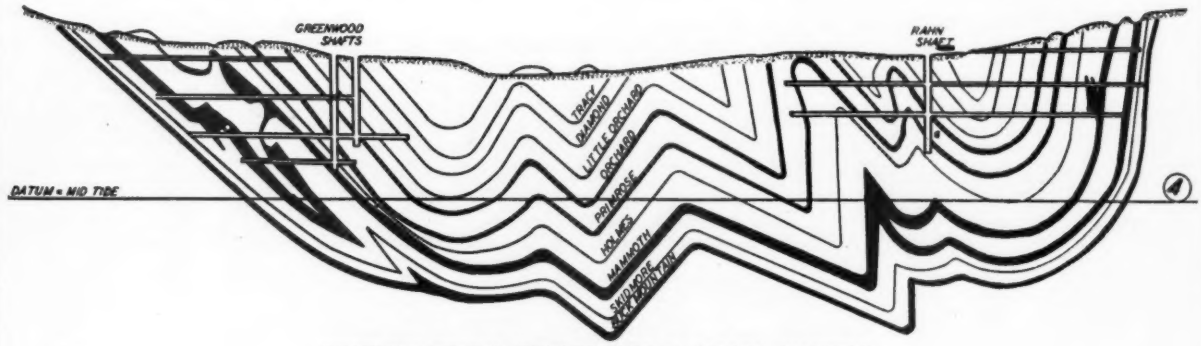
SECTION THRU NESQUEHONING TUNNEL

FIGURE 3



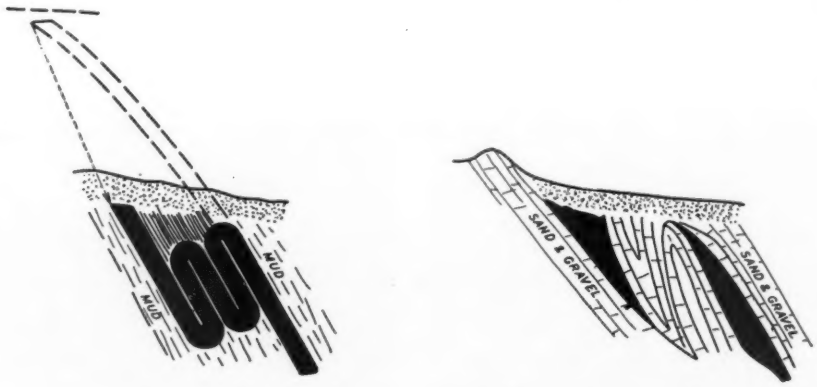
SECTION THRU LANSFORD SHAFTS

FIGURE 4



SECTION THRU GREENWOOD & RAHN SHAFTS

FIGURE 5



SECTIONS SHOWING HOW THICK DEPOSITS WERE FORMED BY FOLDING

FIGURE 6

Lehigh Navigation Coal Company

clines, which upon spooning form ideal stripping areas. This is especially true at Nesquehoning Colliery which is noted for its extensive stripping operations. A few of the main cross-sections, shown in *Figures 2, 3, 4 and 5* illustrate the conditions described.

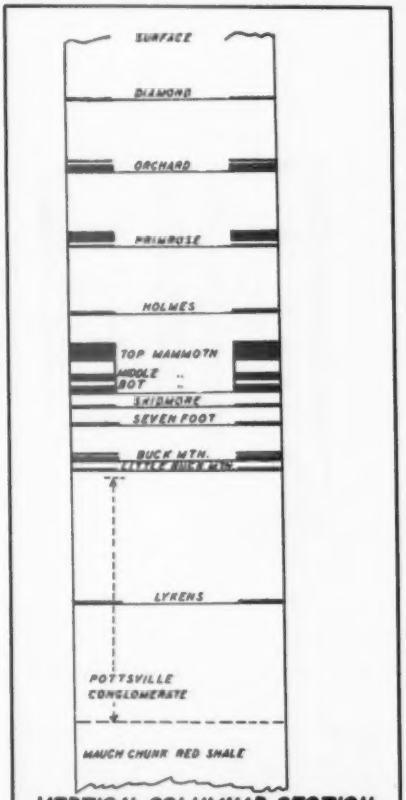
The folding has, in many instances, caused exceptionally thick deposits of coal by overlapping parts of the veins and pushing out the adjacent muds. In other areas where the adjacent rock-forming material, such as sand or gravel, was extremely rigid, the softer coal was crushed and displaced, disappearing entirely in sections—illustrated in *Figure 6*.

At the time of primary folding the materials entering into the formation of the rocks in the coal measures was in a semi-plastic state, while that forming the coal was a compact mass of interwoven vegetable matter of a woody nature. The heat generated by the mechanical action of folding and probably by fires in various beds was sufficient to produce a distilling action on the vegetable matter, charring it, driving off most of the volatile matter, cementing the carbon residue with a resinous substance condensed from the fumes to form the coal, and solidify the surrounding muds, sands and gravel to form the shales, sandstones and conglomerates.

That subsidence of the coal areas occurred generally at stated intervals is proven by the vein formation of the coal measures, the bedding and rock formation showing similarity throughout all coal areas, that is, the various veins and their adjacent rocks can be traced over the entire area largely by the thickness and formation of the vein, and character and thickness of adjacent rock. The intervals between successive subsidence was comparatively short as is indicated by what is known locally as the splitting of the Mammoth Vein into Top, Middle and Bottom Splits. The splitting of the Mammoth Vein starts at Lansford and extends westward through Tamaqua, Pottsville and well on towards the west end of the Southern Field.

Subsidence or excessive floods in local areas explains the presence of slates in certain veins in one locality which are not found in the same vein in another locality. It also explains the presence of what the miner terms a "horse" in the vein, the term "horse" being used to designate an isolated or suspended piece of rock often found in the thicker veins.

The vertical columnar section shown in *Figure 7* shows coal beds existent in the Panther Valley in their relative positions. Labor rates, thickness and adjacent rock conditions, limit the mining of coal in the area to the Orchard, Primrose and Mammoth Veins, only a few of the thinner veins being worked locally at the various collieries where abnormal thickness has occurred. The conformation is that generally found and explained thoroughly in all geological works, thus requiring no further discussion.



VERTICAL COLUMNAR SECTION SHOWING VEIN SEQUENCE

FIGURE 7

Probably the most difficult work presented by the region to the geologist is solving deformations caused by secondary folding and faulting. The engineer also has many problems presented similarly. He must determine the methods of mining and developing economically, and whether or not the coal is worth mining. The use of haphazard methods of mining soon results in large losses.

ANTHRACITE AND PROSPERITY

(*From page 562*)

if not exclusively by the mining companies, put many thousands of dollars into circulation on each pay day, and quite a number of silk mills, lace curtain factories, and other textile manufacturing plants, attracted by the unsullied atmosphere of the anthracite region, give employment at good wages to hundreds of young women, mostly daughters of the mine workers.

It has been said that under normal conditions the anthracite region is, per capita, one of the most, if not the most, prosperous sections in the United States. It is looked upon as an excellent place for doing business by bond and stock brokers, and, given half a chance, the anthracite industry will continue, in its way, directly and indirectly to contribute to the prosperity of the country.

ANTHRACITE SERVICE

(*From page 575*)

anthracite and its advantages are also prepared and furnished, without charge, to retail coal merchants, for redistribution by them.

Anthracite Coal Service representatives also take every opportunity to address technical societies, Rotary and Kiwanis Clubs, civic and church associations, public schools, etc., and, through Anthracite Coal Service, the anthracite industry is represented by exhibits at the Better Home Shows, Heating and Ventilating Shows, and similar exhibitions, where the service provided by the industry to the consumer is graphically displayed.

The anthracite industry's service to its consumers may, therefore, be summed up as the preparation and delivery of highest quality fuel, supported by an intelligent engineering service which assures its customers of full value in comfortable and satisfactory heat for every dollar invested in the purchase of anthracite.

THE SMALL DOMESTIC STOKER

(*From page 577*)

operator and the retailer that their satisfactory operation is being made possible because of the uniform quality of the fuel.

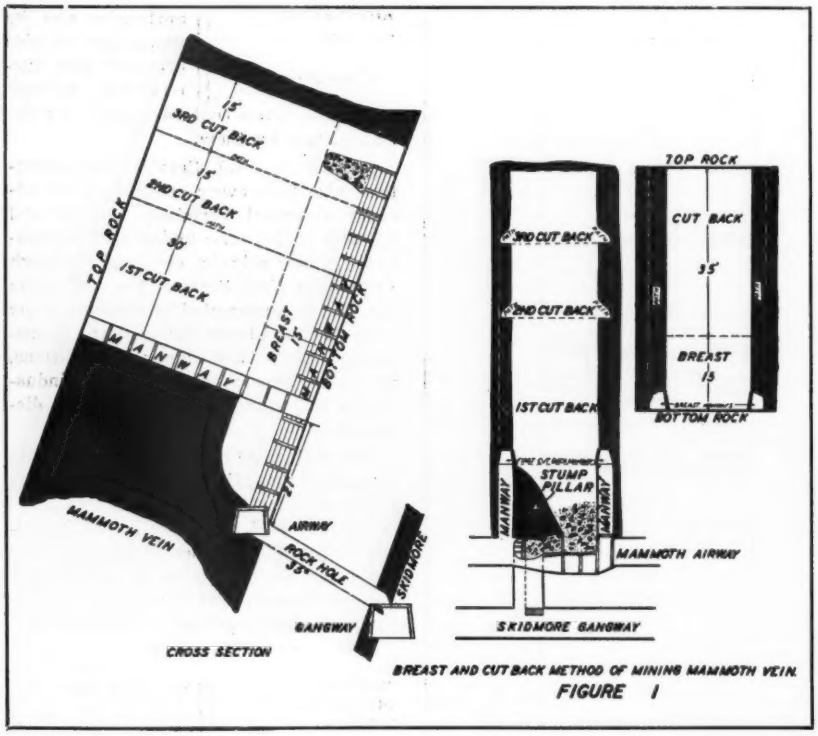
Careful preparation, combined with the natural safety, cleanliness and economy of anthracite, and with the self-stimulated demand for labor saving machinery of all types can not be disregarded as a factor and even as the future solution to the heating problem.

Consumer Protected in Three Ways

The owner of automatic anthracite equipment of this kind has in fact three agencies actively guarding his comfort, health and heating satisfaction. The anthracite producer maintains a most rigid guard to assure a shipment of anthracite which is best suited to stoker operation; retailers have been trained by Anthracite Coal Service to enable them to render adequate and efficient heating service; whereas the stoker company guards the successful and continuous operation of the mechanical equipment through improvements in design and service.

Domestic stokers for burning anthracite automatically are, therefore, not only practical when considered from every angle, but are an expression of the modern trend in the mechanization of the home. Modern equipment, coupled with a complete supervision of the heating system by trained engineers, is past the experimental stage. The full realization of the heating comfort which the combination affords is the one remaining step in the modernization of heating.

Lehigh Navigation Coal Company



BREAST AND CUT BACK METHOD OF MINING MAMMOTH VEIN.

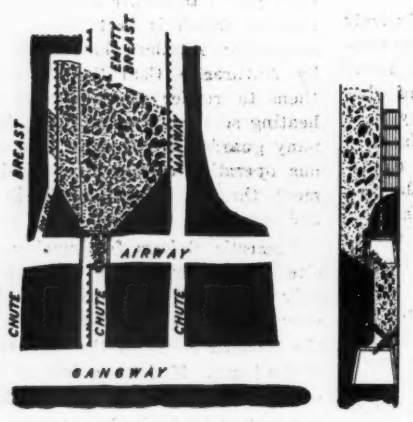
FIGURE 1

METHODS of mining used in the heavy pitching seams of the Panther Creek Valley Collieries of the Lehigh Navigation Coal Company vary according to pitch, nature and thickness of the coal, and condition of the top rock. Generally speaking, all methods in use are either the breast and pillar skip method or a modified form of it.

Early mining, confined to the upper levels of the Mammoth and Primrose veins, was done largely by means of slopes and gangways driven in the veins. Later, as the mining extended to lower levels and the main haulage ways became more difficult and very expensive to maintain, primary haulage ways were driven in rock or the thin veins underlying the Mammoth vein. From the main haulage ways, at intervals of 1,000 or 2,000 ft., panel tunnels were driven and off these short gangways were driven in the veins, thus permitting the mining and robbing of the section before the gangway required major repairs. With further improvements in drilling machines and explosives for blasting, development work has turned more and more to the rock, so that today the gangways and airways are driven mostly in rock and mining of the veins is done through rock chutes off these gangways to the vein.

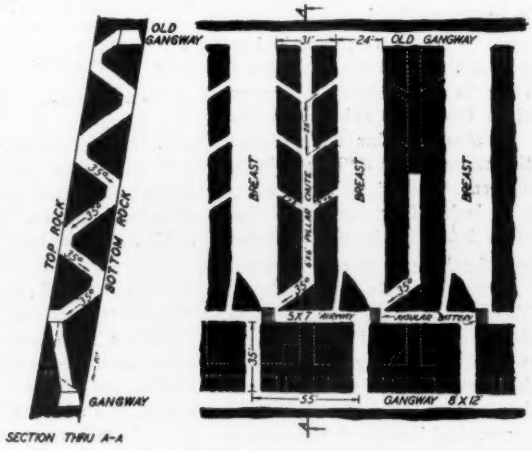
Mining of the larger veins is usually done as illustrated in *Figure 1*. This shows the gangway driven in the Skidmore vein under the Mammoth with rock holes usually on 60-ft. centers. If the Mammoth vein is exceptionally thick or the lift to the upper gangway long, then chutes are driven in the Skidmore vein to a mid point and a second set of rock holes driven back to the Mammoth, where mining is carried on in the same manner as that from chutes directly off the gangway. To start mining, the first opening to be made in the vein is an airway connecting the top of the rock chutes. Next manways, one starting off on the side of the rock chute and the other in far enough to give proper breast width of 6 or 8 yds., according to size used, are driven parallel up the pitch for a distance of about 20 ft. Between the manways a juggler battery is formed and inside of this the opening is gradually enlarged to a breast height of 15 ft. and width until it connects with the top of the first manway, leaving over the airway a triangular shaped pillar of solid coal, commonly referred to as a stump pillar. The breast is then advanced to the old workings above if the vein thickness does not exceed the standard breast height.

When the vein thickness is greater than standard breast height, the coal above the breast is mined by the cut-



PILLAR SKIP METHOD OF ROBBING

FIGURE 2



METHOD OF WORKING THE TOP SPLIT OF MAMMOTH VEIN

FIGURE 3

METHODS

By

By **W. S. Rausch**
MINING ENGINEER

back system. The first cut back is started 21 ft. above the airway and is made by driving two manways to the top rock and at right angles off the breast manways. The coal between the cut-back manways is cut out between the manways and up the pitch for a distance of 30 ft. The second cut back and subsequent ones are made similarly, except that the manways are not used, the miner merely cutting a path in the rib coal to provide access to top coal to permit drilling and shooting. The breast is kept full of loose coal until the breast and cut back reaches the old workings above, only enough coal being drawn from each cut to take care of the increased volume caused when the coal is broken from the solid. The loose breast coal is then loaded or left standing, depending on the method used to extract the pillar coal.

Figure 2 shows the pillar skip method used when veins are not exceptionally thick and good roof conditions exist. To use the method successfully, the breast is stopped short of old workings to provide a chain pillar to hold back the gob in the old workings and permit emptying the breast. After the breast has been emptied, the old manway next to the battery is blocked and the miner starts cutting the rib coal, gradually widening the opening to break into a pillar chute or dog hole started and driven off the airway or the manway of the outside breast, at a point about 8 ft. from the outside breast rib. A new manway is started from here and the skip is carried up the pitch in the same manner as the breast was driven, the loose coal running into the empty breast. No coal is loaded until the loose coal interferes with the cutting of the pillar, when loading is started and handled as when the breast was driving. The inside breast manway is kept in repair until the skip is completed. The narrow pillar along the outside manway is either blown or allowed to crumble and fall as the breast and skip loose coal is loaded.

In thick veins, especially where a poor top rock overlies the vein, the pillar chute method of extracting the pillar coal is used. This method, as shown in *Figure 3*, is as follows: First, a slant chute is started inside of the battery and driven to the center of the pillar, where it connects with a pillar chute driven off the top of the rock chute or a pillar chute from the coal gangway, as is shown in this figure; a chute is then driven up through the center of the pillar to the old workings above; in some instances, this follows

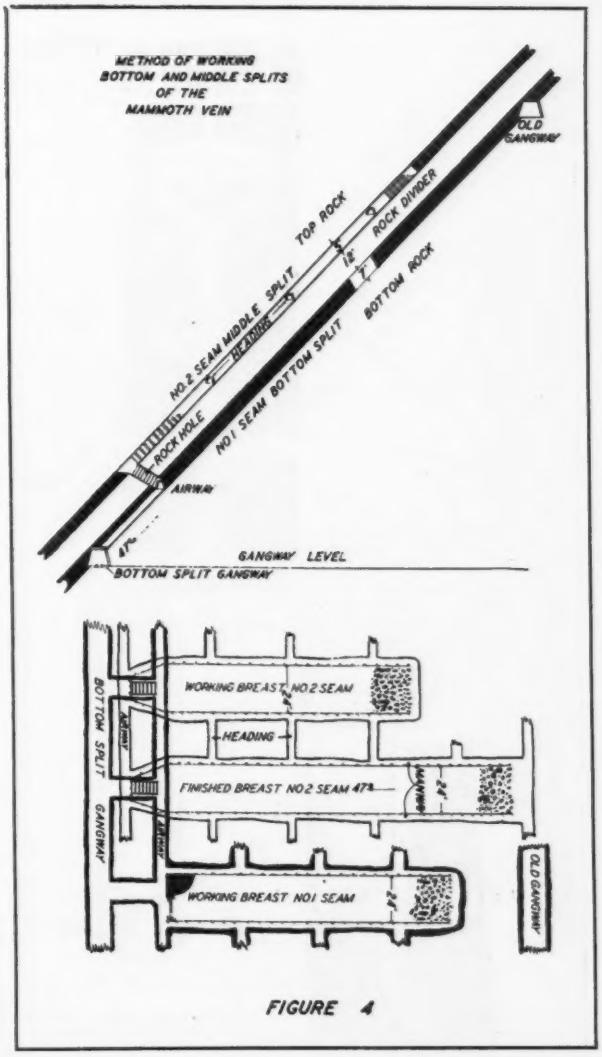
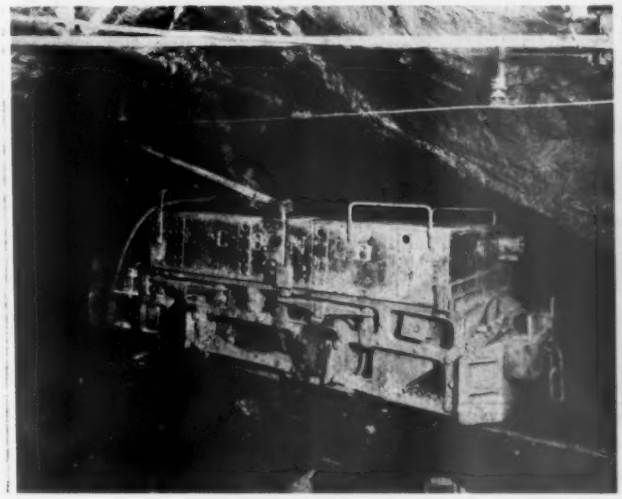
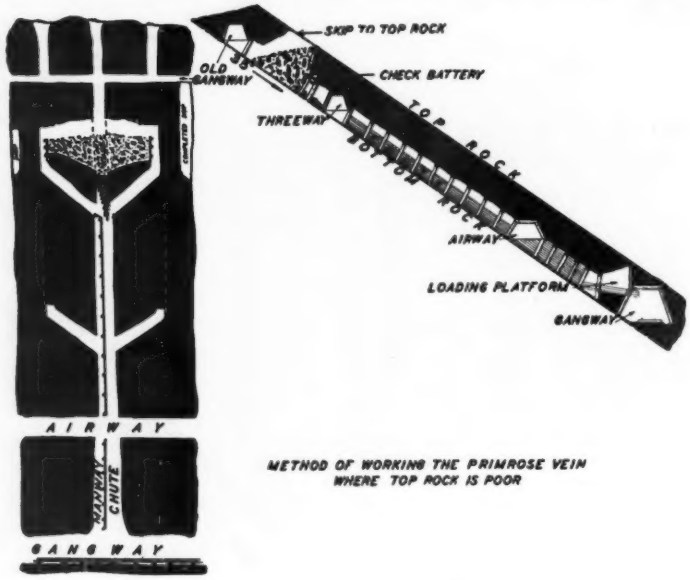


FIGURE 4



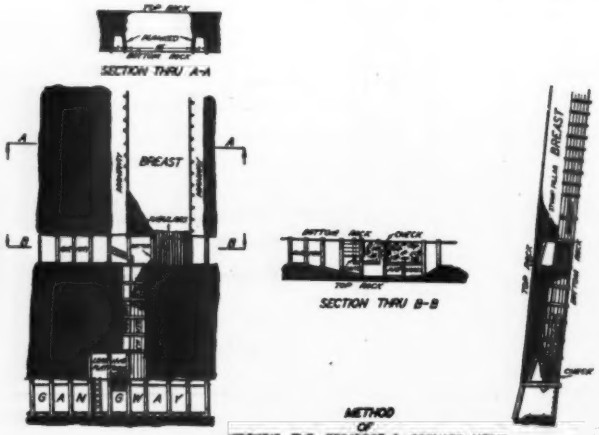
Nesquahoning Third Level Haulageway

Driving a Rock Tunnel



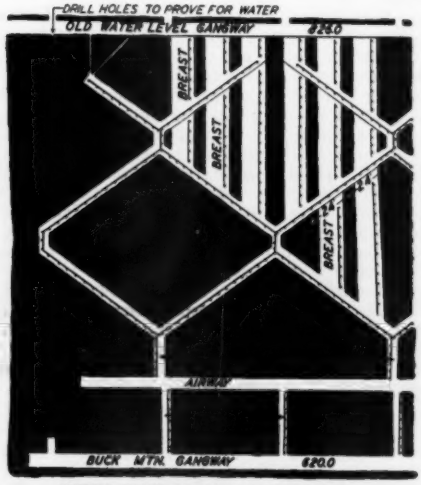
METHOD OF WORKING THE PRIMROSE VEIN WHERE TOP ROCK IS POOR

FIGURE 5



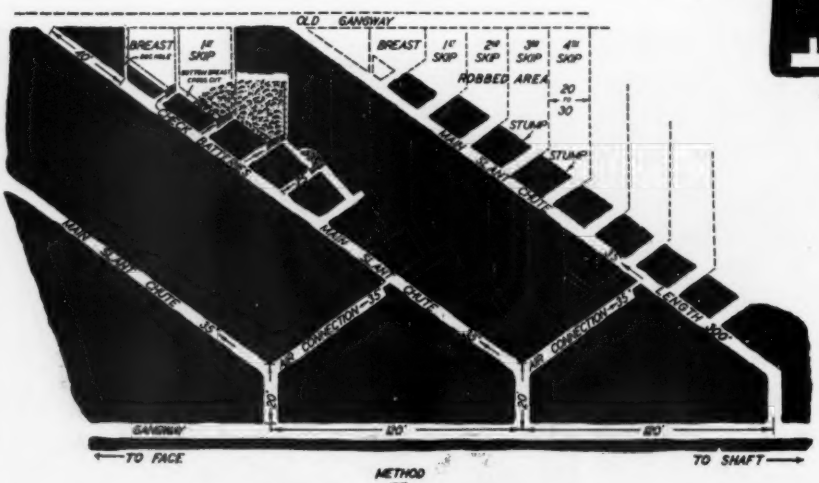
METHOD OF WORKING THE PRIMROSE & ORCHARD VEINS DETAILING JUGULARS

FIGURE 6



METHOD OF WORKING BUCK MOUNTAIN VEIN

FIGURE 8



METHOD OF WORKING VEINS OVER 50° DIP BY BREAST AND SKIPS

FIGURE 7

Lehigh Navigation Coal Company

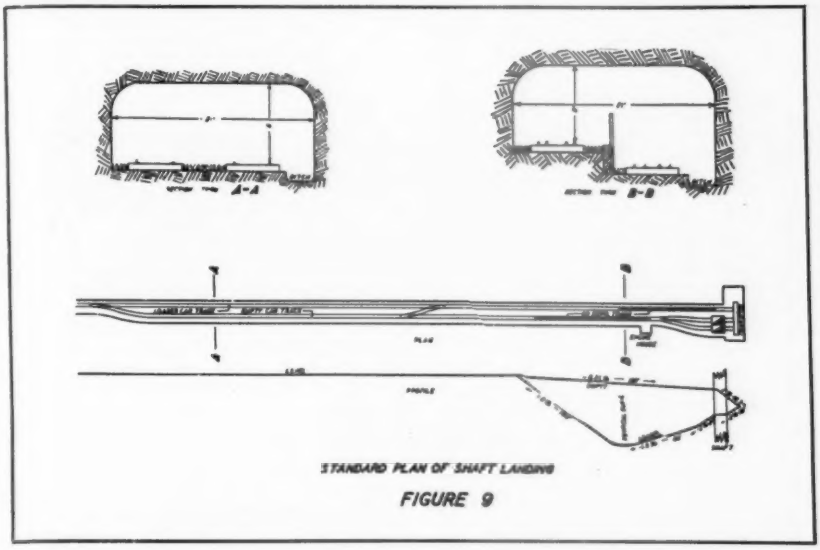


FIGURE 9

the bottom rock, but is usually driven on a 35° pitch back and forth from bottom to top rock; when the pillar chute is completed, the next step is to drop down 25 or 30 ft. below the old workings and drive slant chutes off the pillar chute to the breasts on either side; skips are started off these slant chutes and extended to the old workings; while extending the skip the miners will have started a second set of slant chutes a like distance down the chute so as to be ready to start the second skip when the first has finished. The operation is repeated until the entire pillar has been cut. The lower skip is not started until all of the coal from the upper skip has been loaded and rock starts running. As soon as the rock comes, the upper skip battery is blocked off and the lower skip started, thus giving a continuous run of coal. This method is worked either with the adjacent breasts full of coal or empty, depending largely on local conditions. Usually they are left full and as the pillar is robbed the loose coal is drawn through the breast batteries and the pillar chute.

Contiguous seams are worked as illustrated in *Figure 4*. In ordinary pitches the top seam is worked first and then the lower vein. Often in heavy pitch work the mining of the two seams is done simultaneously, especially is this true where the dividing rock is poor and has a tendency to break and heave if one seam is mined before the other. When running the two seams simultaneously, the breast loading is done, attempting to keep the top of the loose coal in the two breasts at the same level by controlling the flow from each at their respective batteries, thus leaving much of the dividing rock in the breasts or standing unbroken between them. The same policy is followed in extracting the pillar coal.

Veins of slight pitch and poor top rock are usually mined by the chute and skip method, as shown in *Figure 5*. Chutes connected by crosscuts above the airway, as required by law, are driven off the coal gangway, or off the top of the rock chutes, if rock gangway and rock chutes are used, to the upper lift. After the chute has reached the old workings slant chutes are started off the main chute at a point 25 or 30 ft. below the old workings and driven to leave a narrow pillar between their ends and the adjacent workings. Two sets or more, according to nature of the coal, above the point of starting the slant chutes, a check battery is placed, and directly above this the miner starts cutting the pillar and widening the opening to break into the first length of manway off the face of the slant chutes, which are extended as the skip advances. The skip is held full of loose coal until the old workings are reached. The loading of loose coal is then started and continued until rock starts running, when the check is blocked off and work started on the lower skip. The small pillars on either side are blasted while running coal from the skip. The small stumps are taken with the lower skip. This method is best for maximum recovery, since the opening made is comparatively small, and it is therefore possible to run and load most of the coal before any major break in the top of rock occurs.

The "Jugglar Battery," portrayed in *Figure 6*, is extensively used in steep pitching veins. Its prime purpose is to facilitate the running of coal from the breast and also to form a by-pass for the air through the airway. Few people are able to visualize the jugglar battery from the usual description given and are unable to form the proper idea of its constructions, unless they have been in the mines and actually inspected it. The sketch has been made to portray the battery as nearly life like as possible to assist in the following description: To form the battery widening of the airway is started three or four sets outside of the loading chute and continued gradually to 9 ft. at the chute. This width is carried for three sets, or a distance of about 15 ft., where it again narrows to ordinary airway width, usually in the space of one or two sets. In the last 10 ft. of the wide section and inside of the loading chute, two long sets and an intermediate short set are placed to support the stump pillar over the airway. Next, a vertical row of heavy props are placed skin to skin in line with the bottom leg of the intermediate set and parallel to the bottom rock. On the inside of this row of props the opening toward the airway is blocked off tight with plank or holes, depending on the weight to be supported, while on the outside end toward the loading chute a check is formed by placing two or more vertical props skin to skin and a similar number horizontally and near the top, thus forming a hole about 2 ft. square at the bottom of the battery to allow the coal to run from the battery into the chute. The flow of coal through the battery is controlled by the loose coal in the loading chute. As coal is loaded from the loading chute, coal flows from the battery tending to keep the loading chute full at all times. The breast is formed by widening two ways inside of the battery, toward the top rock and outside manway until the opening reaches the top rock and cuts into the outside manway 15 or 20 ft. above the airway. Full-breast width and height is then carried up the pitch from this point.

Thin veins with poor top and bottom rocks or exceptionally thick veins having pitches of 50° and over are often worked as shown in *Figure 7*. The method is rather high in cost due to the large amount of narrow work required, and high maintenance cost of main chutes while running coal, is difficult to ventilate, but has the advantage of permitting a large production of clean coal. The mining is done either from a coal gangway, as shown in the sketch, or from an underlying rock or thin vein gangway with rock holes to the vein off the gangway. Usually in mining thin veins a coal gangway is used, while the rock gangway is used where the vein is quite thick. If the vein is exceptionally thick, a system of rock slant chutes under the vein is used to reduce the high maintenance cost in the main chutes used to run coal.

The method using the coal gangway will be described, as it is applicable to methods using the rock or thin vein gangways: First loading chutes spaced 120 ft. apart are driven off the gangway to a point about 20 ft. above the gangway. From this point a main slant coal chute is driven on a 35° pitch over the gangway and an air connection is driven in the opposite direction on the same pitch to establish ventilation. If the vein is very gaseous, these air connections are made every 60 ft. or oftener, depending on the quantity of gas to be handled; ordinarily they are driven using a small blow fan and vent tubing. Mining is started on the outside chute, but never before the inside chute has been completed to the old gangway above; better ventilation is obtained if the old gangway can be opened and maintained as a secondary airway in advance of the mining. The first mining done off the chute is by means of a short breast started 40 ft. below the connection of the main chute with the old gangway. While the breast is being driven by one party of miners, the first skip is being made ready to drive by a second party of miners, and the chute for the second skip is started by the first party of miners. The skip width used, depending on local conditions and vein dip, determines the spacing of the skip-loading chutes along the main slant chute. Usually a 24-ft. skip with a corresponding chute spacing of 25 ft. prevails. To open out for the first skip a bottom breast crosscut is made from the check battery in the skip chute to connect with the breast manway. The second skip uses a bottom breast crosscut to connect with the manway of the first skip, etc. The miner now starts

Lehigh Navigation Coal Company

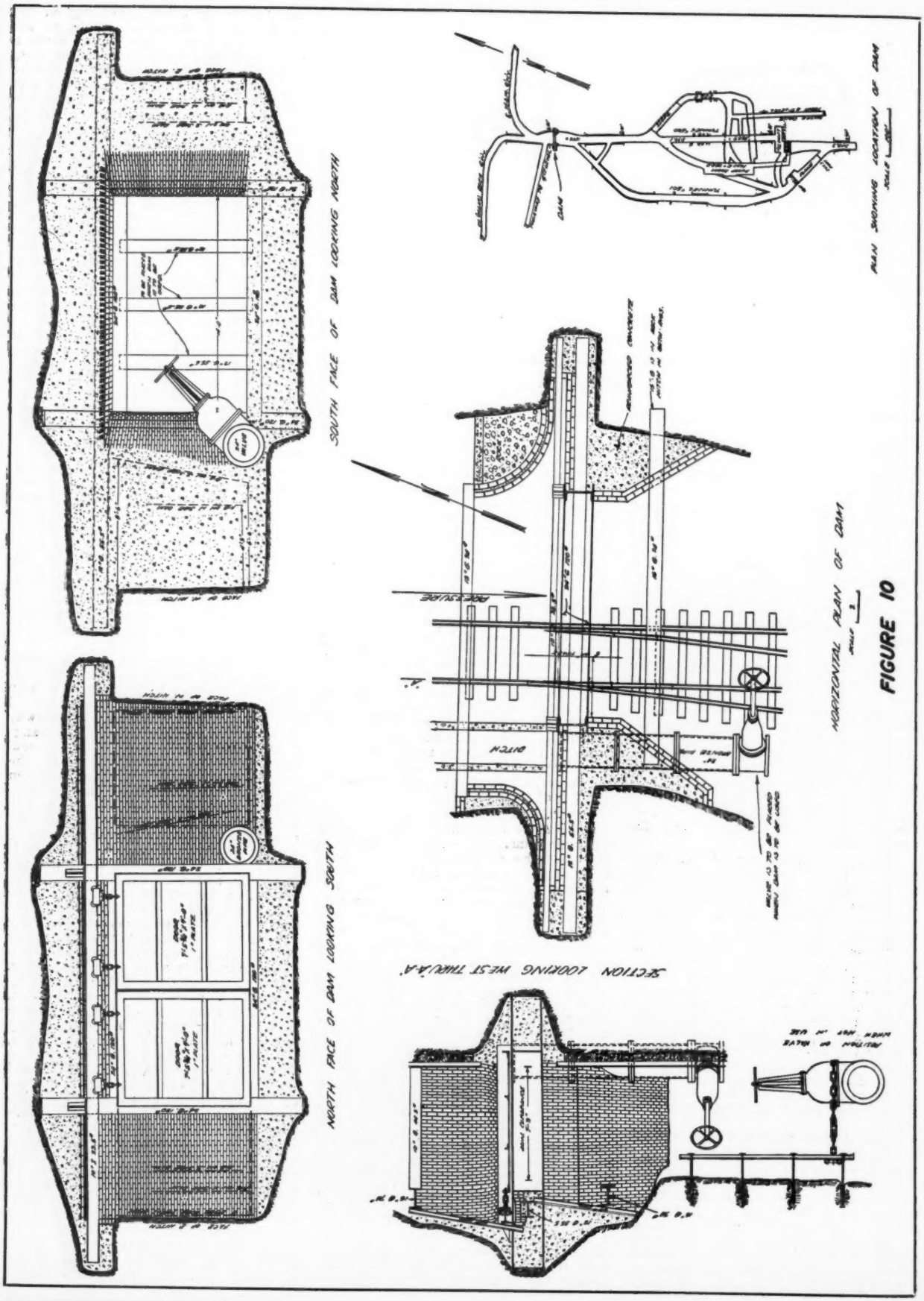

SOUTH FACE OF DAM LOOKING NORTH
NORTH FACE OF DAM LOOKING SOUTH
SECTION LOOKING WEST THRU A-A'
HORIZONTAL PLAN OF DAM
PLAN SHOWING LOCATION OF DAM
DITCH

FIGURE 10

Lehigh Navigation Coal Company

cutting the pillar above the bottom breast crosscut and forming the outside manway of the skip. Always the outside manway of one skip forms the inside manway of the other skip, and it is coupled to hold open until the skip is completed.

The breast is held full of coal until the first skip has completed driving. When loading is started, the first skip is kept full and loading not started until the second skip has finished driving, etc. The breast and skip stump pillars are left standing until all skips in a panel are completed; they are then cut and robbed as far down the chute as ventilation requirements will permit. Large gangway stumps result by this method, and robbing of these by ordinary method on the retreat yields a large production, even though a short pillar is left over the gangway to hold it open for ventilation to mining on the next lower level.

The breast length is usually 50 ft. and the skip length increases to a maximum of about 110 ft., according to the pitch of the vein. The short length of opening permits the extraction of the coal before the top rock breaks, giving a shorter vertical drop for the coal, therefore netting a cleaner product and a greater percentage of the larger sizes than would result were the veins worked by the ordinary room and pillar method.

Mining shown in *Figure 8* is of the same nature as that just described, differing only in that it uses narrow breasts and pillars. The pillars are drilled as the breast advances and are blasted, starting at the top as the breast coal is loaded out. A detracting feature is that, if the coal is very hard, the small amount of drilling and blasting done in the pillars fails to cut them properly and much of the pillar coal is lost, top rock having fallen in the breast and blocked the battery before they receive the crushing weight of the subsiding top rock. The method is more expensive than the skip method, due to a more extensive use of narrow work.

No definite system of mining can be recommended for a particular vein before some development has been done to determine the conditions that will be encountered. The final answer in every instance is maximum recovery with a maximum percentage of the higher realization marketable coals.

The present trend is toward standardization. Our company has adopted various standards for the mine opening to provide flexibility. The standard tunnel and rock gangway are 8 ft. x 12 ft. in section, main airways and auxiliary airways likewise have their standard sizes according to the service to which they are put. Lately a standard shaft landing has been adopted, as shown in *Figure 9*. The grades shown are for roller-bearing cars; where other types of cars are used the grades are altered to suit. The intention of the plan is to provide a rapid and flexible car handling arrangement, entailing slight abuse to the rolling stock and eliminating costly spillage of coal from the cars. The plan provides for approximately 60 cars storage. Where larger storage is needed, same is provided by turnouts at short distances from the main tunnels.

The geologic structure of the region is such that the great portion of the rain water will rapidly enter the mine workings, unless proper measures are taken to lead the run off away from the numerous crop falls. The best results are obtained by providing deep ditches above all crops to lead the water to points where it will run directly into the streams or to the water level workings. In spite of this precaution, when excessive rains occur, there is danger of more water entering the mines than the pumps will handle. To provide protection under these conditions we have installed at all practical points emergency flood dams (*Figure 10*), which when closed seal off the pump room from the rest of the mine. The dams are designed to withstand a static head of 60 ft. and are equipped with valves to regulate the flow of water to the pumps.

ANTHRACITE ACCIDENT PREVENTION

(*From page 564*)

remedied or removed.

Most of the major companies employ a full-time safety engineer, and it is the usual practice that his time be devoted to inspections tending to prevent accidents rather than to investigating accidents that have occurred, as the latter is deemed belonging properly to the colliery officials to report on.

To further illustrate, the active work being carried on by the companies in their campaign for accident prevention is, for convenience, divided—publicity, discipline and organization.

Various publicity methods are used—local bulletins posted at strategic points, sometimes printed in several languages; official bulletins of the National Safety Council or some other specific safety bureau; safety slogans or captions printed on the semi-monthly due-bills.

In the matter of discipline, strict compliance is expected, of the anthracite mine law and of the company's safety rules; penalizing by suspension or discharge for serious or frequent violations.

Each company organization to carry on the movement is organized according to the idea of the particular operator, embracing, as it does, officials of the company, local colliery foremen, and its safety department, with which is associated groups of men trained in the use of rescue apparatus, most of them holding a certificate of efficiency in rescue work issued by the United States Bureau of Mines.

In this campaign it is found to be of imperative value at all times to instruct the individual workmen, and to continually reiterate same, that they should exercise care, observe the state laws, and the company's safety rules; likewise to maintain close official supervision, and where gross negligence is present, to apply a standard of discipline.

The Federal Bureau of Mines and the State Department of Mines are rendering valuable assistance in the movement, and the secretary of the latter issues monthly to the operators a statement of the fatal and serious accidents, giving the name of the company and the cause of the accident, for the purpose of having it constantly available as a warning or guide to avoid similar accidents.

It is becoming a generally accepted procedure to have regular safety inspections made by some one who is not under the supervision of the local colliery officials, and all unsafe conditions or practices are reported on. It is also being found of practical value to place each colliery on an inspection rating basis, starting at a uniform figure for standing, giving credits for merit items and charging penalties for demerit items, which method can be readily carried out by standard schedules, whether insurance is handled direct by the company, an insurance carrier, or by the state department. Some of the companies find they create extra endeavors and interest, by each of the bosses concerned, in furthering the safety movement, by giving to their bosses a monthly schedule showing the relative standing of each section of the mine as to the days lost from accidents for the month and for the year to date.

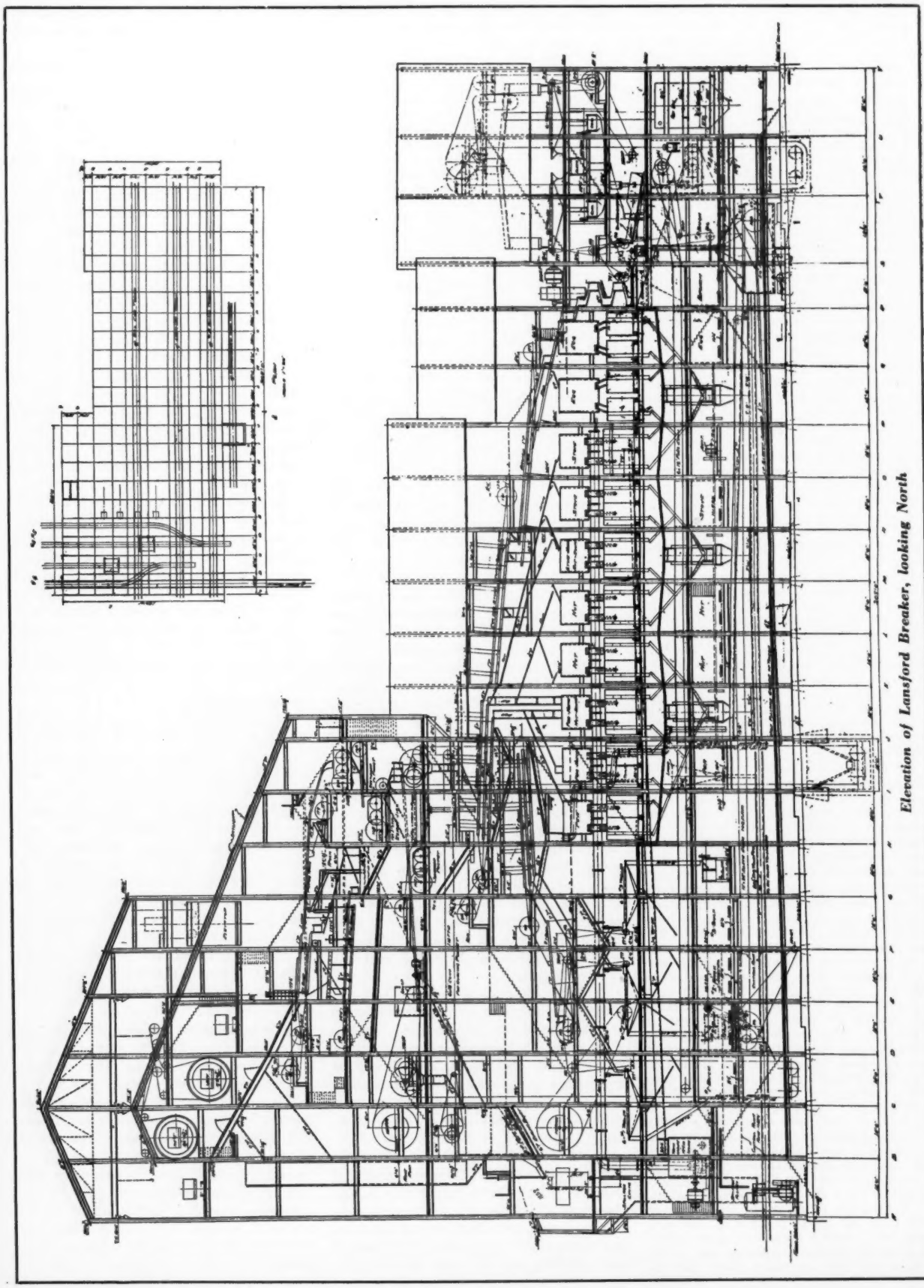
First aid work is considered a valuable adjunct in the safety movement, because it aids early recovery in the case of injury, and in the saving of many lives because of prompt treatment. First aid work was first started in the anthracite field in 1900, and today it stands in a high rank for efficiency. It should, therefore, be rated as a valuable asset, even though some may term it indirect, in limiting the loss of earnings and severity of injury.

The trained rescue corps are a potent factor in the prevention of more numerous accidents when an emergency arises, since in most cases those in danger in a mine are promptly rescued in safety.

All of the larger companies, and many of the smaller companies, are well equipped with oxygen apparatus, gas masks, inhalators, and gas detectors. Over 1,100 trained men, certificated by the Federal Bureau of Mines, are available for immediate call, and whenever an emergency arises anywhere in the field, it is only natural for every company, especially those in the immediate vicinity, to promptly offer the services of its men and equipment.

In conclusion we can say, without fear of contradiction, that "Anthracite Accident Prevention" is a live subject throughout the entire field. The safety movement is not limited in activity for want of proper support, whether financial, humane, or individual. The safety education campaigns will, we trust, eventually result in the unanimous and enthusiastic cooperation not only by the company from the executives down to the minor bosses, but by every individual workman whatever be his work or occupation.

Lehigh Navigation Coal Company



Elevation of Lansford Breaker, looking North

Lehigh Navigation Coal Company

BREAKER Design and Construction

By **A. G. Frank**
MECHANICAL ENGINEER

THE design and construction of the breakers or preparation plants of the Lehigh Navigation Coal Company differ from those in general use throughout the anthracite region. This difference is due to the size of the raw material and the high percentage of refuse it contains. The coal deposits of the Panther Valley are thick and heavy pitching. Mining is necessarily done by the chute method and gobbing of rock and refuse inside the mines can not be done.

Headhouses or cleaner houses, as sometimes called, are used generally, and are either separate structures or built directly on top as a part of the main breaker building. Run-of-mine coal is treated and only the large sized refuse removed.

Some conception of the kind of material handled is disclosed by the fact that all chutes and openings must be large enough to permit pieces of coal or refuse 6 ft. in width or length to pass. The refuse content in the large sizes is about 50 percent and in the smaller sizes about 30 percent.

Handling Run-of-Mine to Breaker

Various methods are used to handle the material from the mines to the breaker; the topography of land adjacent to the plant naturally determines this. Car hauls, skips or gunboats, conveyors and direct railroad haul are the methods generally employed. Gunboat hoist, with adequate storage at the dump, is probably the most flexible and efficient type of delivery when conditions allow of its use.

Dumps and Dumping Arrangements

Mine cars were formerly designed with end gates, which permitted the use of manually operated horn and kick-back dumps. Later steam operation was applied. The present standard is an electrically or air operated rotary dump, of either one or two car capacity, permitting the use of solid end mine cars.

Breaker Structures

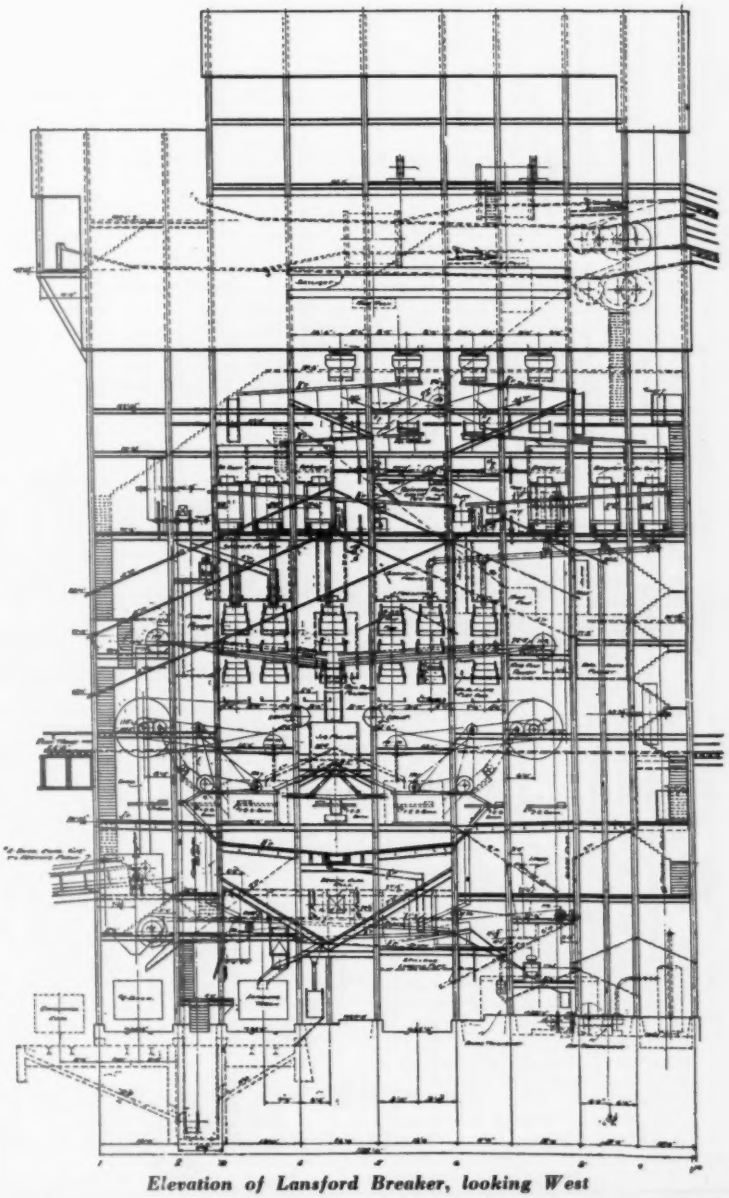
All original breaker structures were built of wood on masonry piers. The first change from this design was in 1909 when Coaldale Breaker was built with a steel headhouse, steel conveyor frame and main breaker columns of cast iron pipe with wooden ties and wood sheathing. These cast iron columns withstood both the vibration and the corrosive action of the acid water.

The main columns of the old Cranberry Breaker, built in 1895, were the built-up type, using two bars and plates of wrought iron. They withstood the action of the acid water for many years, and where not subjected to acid water, showed no appreciable amount of scale, though without a protective coating practically throughout their life. The tops of the original columns are still in excellent condition, and it was necessary in recent changes to renew only the lower sections.

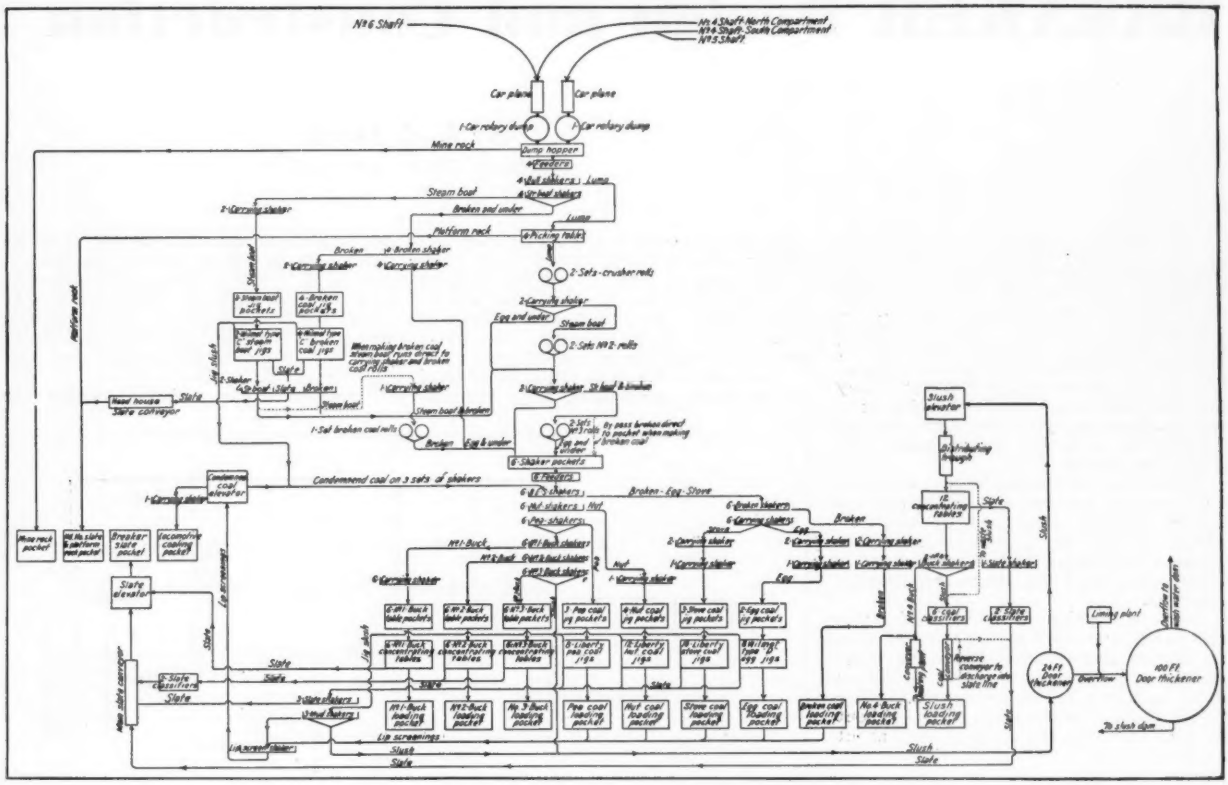
In wood breaker construction long-leaf yellow pine is used. Sizes vary from 14 in. x 18 in. to 6 in. x 6 in. for post and ties, while for the roof 3 in. x 8 in. is generally used. The usual centers of columns are 16 ft., but this is naturally varied to meet special conditions.

Our modern breakers are built of steel on concrete foundations, with concrete floors, pockets and concrete mat on entire ground floor. Sides and roofing are of protected metal or corrugated asbestos, and windows are of steel glazed with ¼-in. rough wire glass. Steel columns are of the H-beam type with both standard and H-beams for struts and machinery supports.

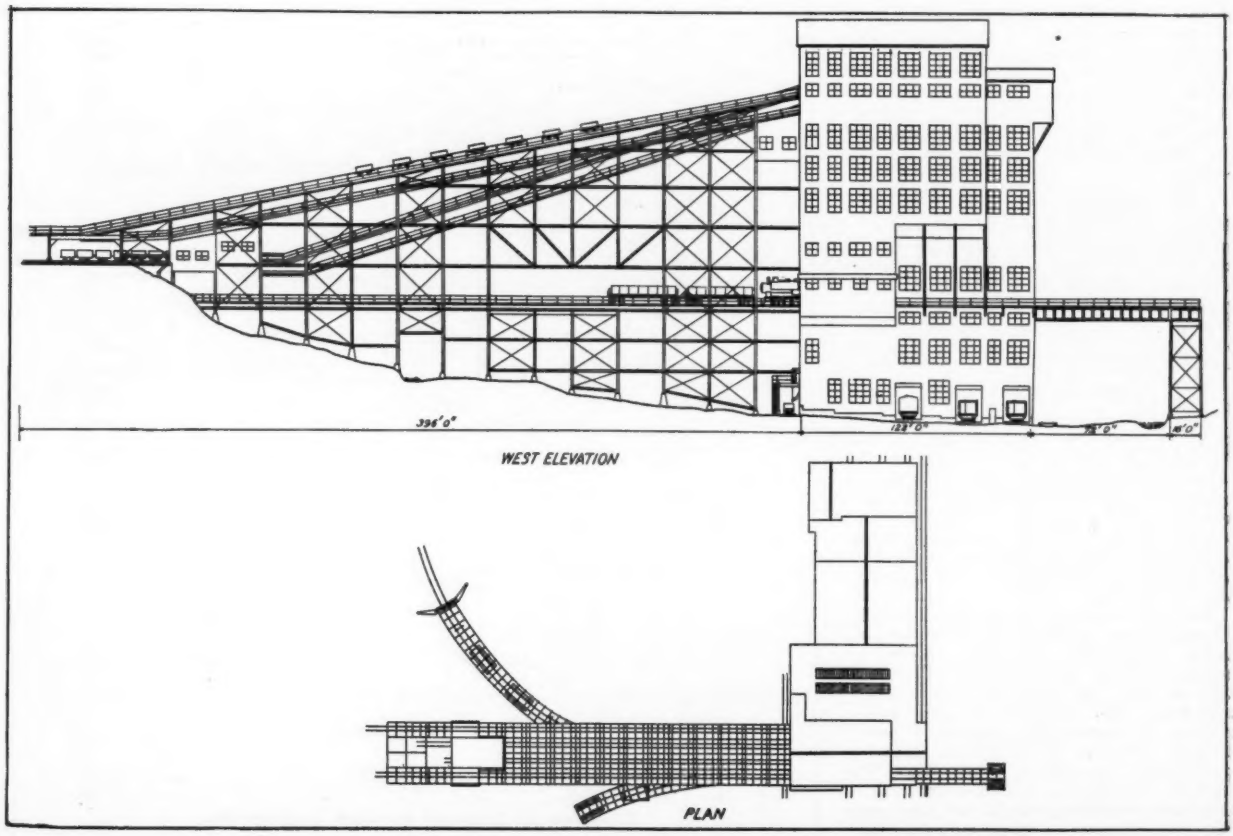
Concrete floors and mat under the



Elevation of Lansford Breaker, looking West



Flowsheet of Lansford Colliery Breaker



General arrangement of Breaker and car plane showing outside features, Lansford Colliery

Lehigh Navigation Coal Company

Lansford Breaker, Lehigh Navigation Coal Co., Lansford, Pa.

breakers are pitched to a common point, so that the spillage can be flushed with a hose to the lip screen elevator to be reclaimed. Considerable labor saving and better appearance result.

Handling of Run-of-Mine in the Breaker

The general practice has been to dump run-of-mine coal into a chute or pocket at the top of the headhouse and feed by gravity.

Originally the coal was run over grizzlies or bars, where the fine material went through to revolving screens. Large material was delivered to a platform built with a light pitch, where the refuse was separated by hand and sent to the refuse chute, the coal being sent to toothed rolls and ground to finer sizes. Hand labor was employed in breaking up the larger pieces of coal before going to the rolls.

The next development in this first separation was to run the raw material over a large shaker 6 ft. wide, called a platform shaker. The large material went to a gravity table constructed with room on each side for hand pickers. Refuse was pulled from the table by hand and dropped in the refuse chute, moving by gravity to the pocket. The pure coal passed over the table into a set of large rolls without further handling. The present method substitutes a shaking picking table for the gravity table, resulting in reduced labor, better separation, and simplified breaker construction.

Handling Prepared Sizes of Coal—Screening

The old method of sizing coal was by means of revolving screens, which were in general use up to 40 years ago. They were replaced by early shaking screens at this company's breakers. Many refinements and improvements have been made in method of driving and hanging shakers; spring-board hangers and flexible arms are in general use, with eccentrics still used for driving. Throws from 5 in. to 6 in. and speeds from 154 to 165 r. p. m. are used. A recent important improvement using a shaking chute is covered fully under the discussion of chutes.

Separating Refuse from Coal

Jigs or other mechanical means of separating refuse from coal have been in use for over 50 years. Recently new methods, such as the Chance sand flotation process, concentrating tables, hydrotators and the Rheolaveur process, have been adopted.

Spiral pickers were used until a few years ago on the larger sizes of coal, such as "steamboat" and "broken." These sizes are now prepared in large jigs of modern design.

Chutes and Pockets

Conveying coal to and from the jigs and shakers and to the pockets, while seemingly a simple matter, is actually an important problem, involving as it does satisfactory preparation and increased value of product by eliminating breakage.

The ordinary chute is built of wood, lined with sheet iron. A carrying chute now used extensively was developed to save height and breakage. This is built in the same manner as the sizing shaker but with a solid pan; the speed is greater and stroke shorter.

Pocket and lip screen construction is little changed from previous practice, but a marked improvement made recently is the use of a chute of the box type raised and lowered electrically to handle material from pocket to cars. This has been a great factor in saving breakage.

Statistical Data

This company owns and operates 8 complete breakers; 4 are of wood construction; 2 of steel and wood, and 2 of steel and concrete. Following is statistical data covering the latest and largest structure—Lansford Breaker:

Height, 202 ft.
Width, 122 ft.
Length, 308 ft.
Cubical contents, 4,700,000 cu. ft.
Weight of steel in breaker, 3,595 tons.
Weight of steel in planes and bridges, 1,320 tons.
Total weight of steel, 4,915 tons.
Square feet concrete floor, 90,530.
Square feet steel sash, 44,000.
Capacity in cars per 8 hours, 2,000.
Capacity in material handled, 8,000 tons per 8 hours.
Capacity in finished products, 5,000 tons per 8 hours.
Number of jigs, 29.
Number of shakers, 75.
Number of rolls, 7.
Number of motors, 20.
Total hp. of motors, 2,975.
Concentrating tables, 30.
Number of car hauls, 2 loaded, 2 empty.
Center to center loaded hauls, 320 ft.
Pitch of loaded hauls, 3¾ in. in 12 in.
Center to center empty hauls, 400 ft.
Pitch of empty hauls, 2 in. in 12 in.

LEH'GH NAVIGATION COAL COMPANY

(*from page* 580)

in all its labors is a large consumer of other products. Eight million board feet of timber and planking go into the mines and are set up each year; 84 million kw. h. of electrical energy are used in operating shafts, fans, transportation and breaker machinery; 3½ million pounds of explosives are used in inside operations and strippings; 1,200 tons of sheet steel are consumed yearly in various uses, and a multitude of other commodities are used in large quantities.

The company is also an employer of no mean proportions, for in spite of innumerable labor-saving devices which have been introduced in later years, there remain over 9,000 men on the permanent operating pay roll, who, in 1929, received in wages nearly $15,000,000.

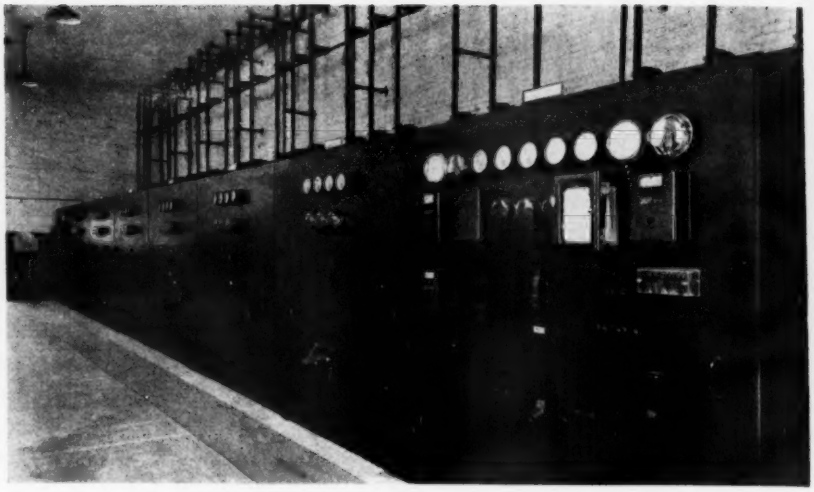
The company is a large taxpayer for purposes of local government. The Boroughs of Coaldale, Lansford and Summit Hill, and the village of Nesquehoning, with a combined population of between 25,000 and 30,000, are dependent almost entirely on the company for their existence and progress, and the company by reason of its operations and land holdings is also a factor of considerable importance in the Counties of Schuylkill and Luzerne.

OBTAINING UNIFORM REFUSE WITHDRAWAL FROM JIG EQUIPPED WITH FLOAT CONTROL

One type of automatic control for the refuse discharging mechanism of a jig consists of a float suspended in the jig bed. As the refuse builds up, the float rises higher and higher on each pulsion stroke until a predetermined level is reached at which it puts the refuse discharging mechanism in motion. The refuse is then withdrawn until the float drops and releases the mechanism.

Recent experiments of the United States Bureau of Mines and the University of Alabama indicate that when this float is used to control a difficult separation the water pressure to the jig and the tonnage of feed should be uniform. The reason for these requirements will be evident when the principle underlying the action of the float is understood. An increase in the height to which the float rises on the pulsion stroke depends upon an increase in the water pressure beneath it. An increase in the pressure against the bottom of the float depends upon an increase in the resistance offered by the jig bed surrounding the float. This may occur either owing to a greater depth of refuse or to a greater depth of total bed of coal and refuse together. Again, it may occur owing to an increase in the amount of water forced through the bed on each stroke. If the impurities are principally shale or slate of high specific gravity, the float will be controlled principally by the depth of the refuse bed; but if the impurities are principally bone, as in the second compartment of a jig, then the float will be affected materially by an increase in the water pressure or in the tonnage and, if the increase be very great, the jig operator may even lose his refuse bed entirely. Thus on a delicate separation the water must be supplied from a tank in place of directly from a pump and the raw coal must be delivered to the jig with a good feeder, preferably of the apron type.

Lehigh Navigation Coal Company



View of interior main Sub-Station. Power from generating plant distributed from this point to the collieries. Note safety type fire-proof construction including truck enclosed switches.

ELECTRICAL FEATURES In Anthracite Production

By

R. E. Hobart

MECHANICAL SUPERINTENDENT

THIS is an extensive subject, covering, as it does, generation of electricity, means of conveying it from the generating station to the point of application and adaptation to a particular work; in short, the whole field of producing electrical from mechanical energy, its transmission and reconversion from electrical to mechanical energy.

While it is not the purpose to discuss generation of electricity, the question of whether an industry should generate or purchase its electrical power is so pertinent that it can not be ignored. Considering the question in the broad sense of all power requirements, there should be greater efficiency and economy in the use of purchased power.

For some time the industry was somewhat backward in adopting electrification, and not without good reason. Interruption of supply was common. Problems in generation on a large scale had to be solved. This has now been practically accomplished, at least to an extent where the use of purchased power is fully warranted.

The large power companies, with their interconnected systems, have brought about economies measurable in the hundreds of millions of dollars by taking advantage of diversity of load and at the same time have increased their efficiencies. Enormous saving in cost of generating and control apparatus has resulted. This certainly means economy as well as efficiency.

Another important factor is that power generation is a specialized subject; central station men are specialists and are accumulating knowledge and experience in that service which the engineer in industry can not be expected to have. The price paid by industry in high power rates for necessary experimental work in gaining knowledge of electrical phenomena on large power systems has been more than repaid in resultant economies through development of more efficient electrical equipment. Each year will find these large generating and distributing systems more reliable and efficient, with consequent reduction of power cost.

Whether power is purchased or generated locally, there are transmission problems to be solved. These are naturally less complex in local systems with lower voltages and capacities, but are difficult, nevertheless.

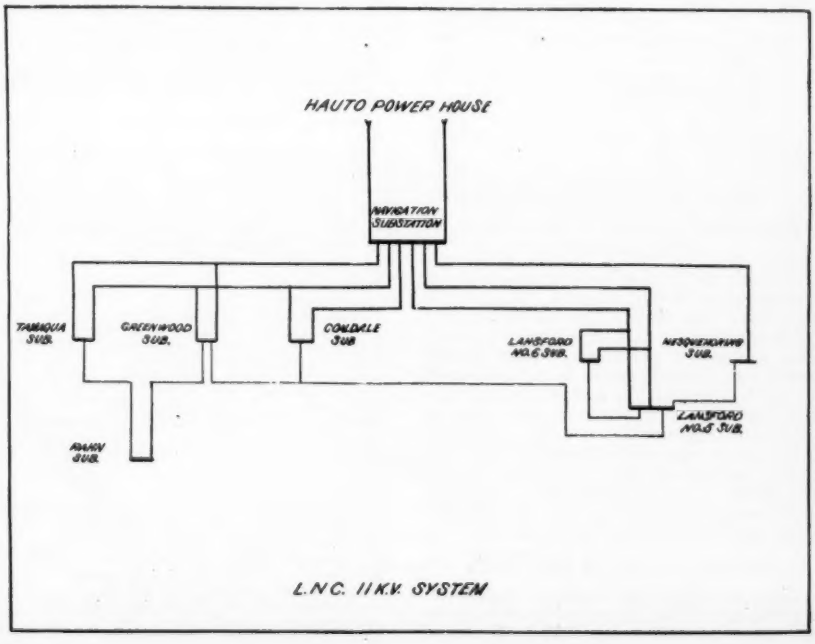
Transmission of power for a group of anthracite mines is more or less special because distribution is affected by local conditions—location of the power station with respect to the mines; location of one mine with respect to the other mines, etc.

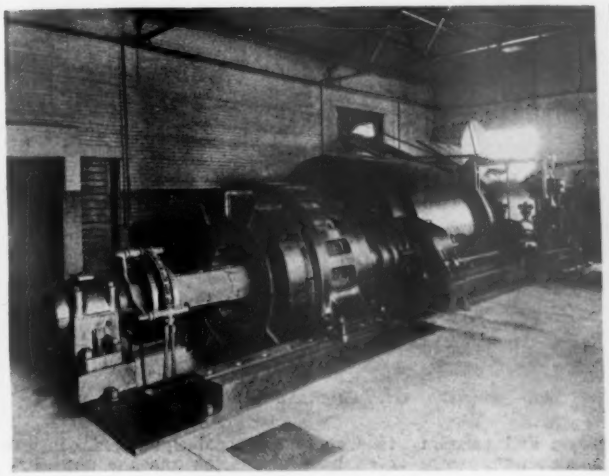
In like manner, the power required is dependent upon local conditions at each operation. This factor, of course, varies with the size of the operation, depth of shaft, length of slope, quantity of coal to be produced per day, amount of mine water to be cared for, volume of air required, length of haulage, pitch of veins, etc.

What is said here must accordingly have application to a particular group of mines, but may be of general interest.

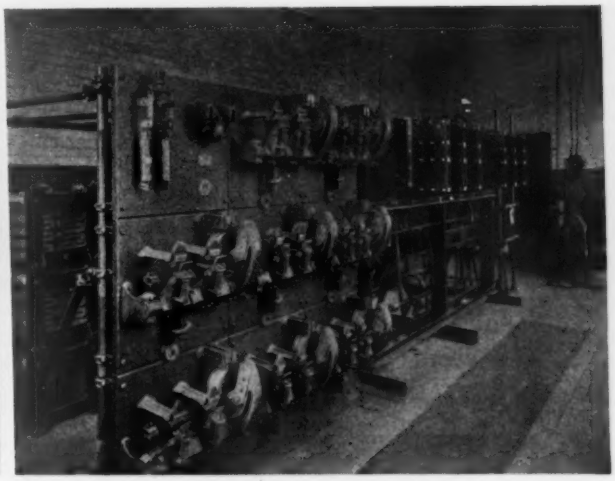
The first venture of the Lehigh Navigation Coal Company into the power business was in 1905, when a power station was constructed at Lansford, Pa. The generating equipment installed in this station, in addition to direct current generators used in furnishing power to a local trolley system and the quarter phase alternators used to supply the surrounding towns with power for lighting, etc., consisted of one 700-k. v. a., 2,300-volt, 25-cycle, 3-phase unit and one 400-k. v. a., 2,300-volt, 25-cycle, 3-phase unit—a total capacity of 1,100 k. v. a.

In 1910 the company took a long forward step in power development by erecting a large generating station at Hauto, Pa., immediately adjacent to its mines. This station was put into service during 1913 and was operated by The Lehigh Navigation Electric Company, a subsidiary of the coal company. Its generat-





1,200-hp. hoist, No. 14 Shaft



No. 14 Mine Hoist switching room

ing capacity consisted of three 12,500-k. v. a., 11,000-volt, 3-phase, 25-cycle turbo generators. The demand of the coal company was then 2,046 kw. on the hour basis and the power consumed 506,570 kw. hrs. per month.

With the new station established, an extensive electrification program was undertaken. Space will not permit us to go into details of this program, but by the end of 1929 demand had increased to 28,500 kw. and yearly power consumption to about 90,000,000 kw. hrs.

In May, 1917, the coal company sold the Hauto plant to Electric Bond and Share Company interests. A new, long-term power contract was made, in which the point of delivery was changed from the several delivery points previously maintained at the mines to a substation adjoining Hauto power station, and additional transmission lines were constructed from the mines to this substation.

Five of these seven colliery lines are constructed on steel towers and two on wooden poles. In addition a tie line connects all substations and line at each colliery which serves as a distribution line from the main colliery substation to the various points of use. All of this transmission is done at 11,000 volts. There are approximately 17 miles of two circuit transmission lines and 23 miles of one circuit transmission lines. The steel tower construction is of the usual A frame type with the square frame type of tower installed where required. The lines are constructed in the vertical plane with pin type insulators used for supports. On the wooden pole lines the wooden crossarm is used.

Lansford Breaker, 500-hp. induction motor; 36-in. belt, 40-ft. centers, driving head house sizing shaker system

The 11,000-volt distribution system between the main substation at the generating plant and the colliery substation is shown in the following one-wire diagram. It illustrates how each colliery has at least two sources of power supply.

The main substations are all constructed of either brick or tile. Layout of the equipment is the usual open work, except in three of the main substations, where safety enclosed trucks are used. These trucks are easily removed and all the equipment mounted thereon is readily available for inspection with no danger of shock.

Control of the electrical apparatus is accomplished by means of the three following methods:

(1) Manually controlled.
(2) Semi-automatic control.
(3) Full automatic control.

Manual control of equipment, with its defects due largely to the personal equation, required the adoption of safeguards for the individual as well as the property under his care. The earliest form of safety device was the fuse wire placed in the circuit, so that under abnormal conditions this wire would burn and automatically interrupt the power supply to the equipment. The saving of life and property by the introduction of the fuse wire is incalculable.

Other safety features followed until greater safety of operation permitted the use of semi-automatic control. A few applications are—

In hoisting duty using the induction type motor safety features make it practically impossible for the operator to cause a wreck.

In control of breaker motors a safety feature is installed which makes it impossible for the operator to impress full current on the motors instantaneously, reducing danger of burns, and protecting the motors from damage by a sudden rush of high current. These are but two of many examples that could be cited.

While automatic operation has not been developed to an extent that will eliminate the operator, in every case, there are many applications where every operation can be performed automatically with full satisfaction. It is an established fact that such operation, where applicable, will work more accurately and satisfactorily than an operator; it will do only the right thing at the right time, which is certainly a measure of safety to life and property.

An example is an electrically operated mine ventilating fan with full automatic control. In starting, automatic control will always function at the proper time and place the fan in operation exactly as it should be done. Hand operation seldom accomplishes this.

With the fan in operation, an indicator is placed at some remote location with a visible signal (red light), which will indicate that the fan is operating. If the motor stops, a green light appears as a visible sign, supplemented by a bell as an audible sign that the fan is shut down.

A break in the power line, too, would, with automatic control, immediately shut off the fan and operate the visible and audible trouble signals. In manual operation such a condition could continue with consequent damage to the motor and a reduced volume of air in the mines.

Danger of damage to fan bearings between the operators' inspections is eliminated by automatic control. Abnormal rise in the bearing temperature will shut off the motor, operate the signals, and damage to the bearings is eliminated, while the delay is also minimized.

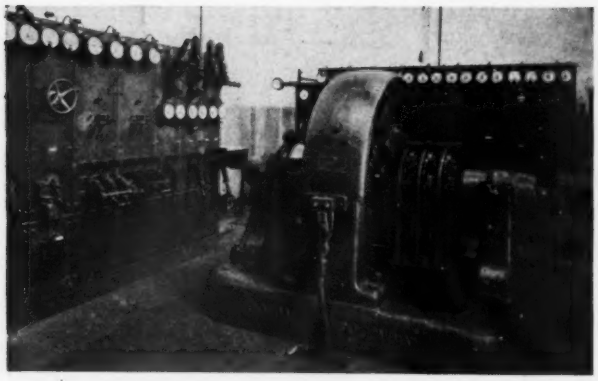
In short, the automatic features are always on the lookout for trouble, and function continuously, while the best operator can only make intermittent inspection.

Another example of satisfactory full automatic control is mine pumping, using centrifugal pumps, the type most difficult to equip for automatic operation.

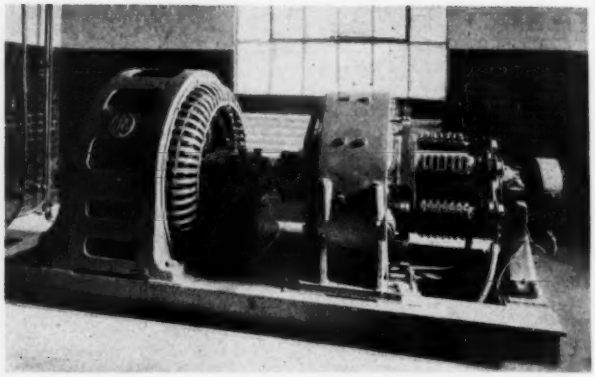
In this case the priming pump motor starts automatically when the water in the sump reaches a predetermined point. After the pump is primed, the motor-driven centrifugal pump starts automatically. When the centrifugal pump motor has been accelerated, the priming motor is automatically stopped. Dropping of the water to a predetermined level in the sump automatically stops the entire pumping station.

If more water is entering the sump

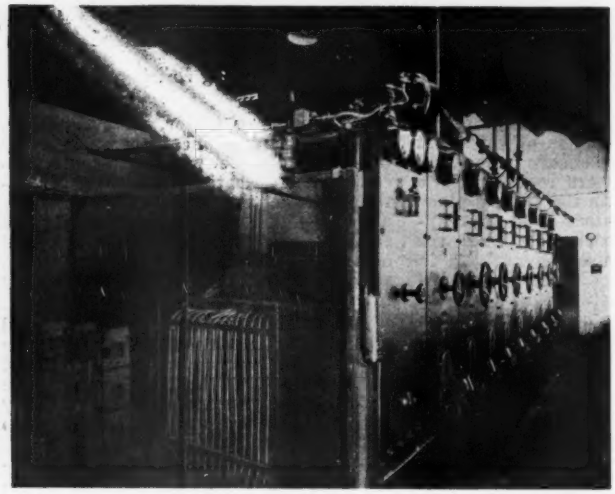
Lehigh Navigation Coal Company



No. 15 Sub-station, rotary converter and panels



Motor generator set, Lehigh Navigation Coal Company



No. 6 Breaker control room

than one pump can care for, the depth will increase until another predetermined point is reached, when a second pump will, in like manner, be automatically placed in operation. This procedure can be used for any number of pumps required.

The full automatic pump installation is equipped with the same protective features as the fan, but it is obvious that additional features of this nature are required. For example, pressure regulators and vacuum regulators are part of the automatic equipment. The function of the pressure regulator is to automatically stop the pump in case of a break in the discharge pipe; the vacuum regulator is to automatically stop the pump if a leak develops in the suction pipe. Another protective device prevents the pump starting unnecessarily more than three times, due to any unforeseen trouble in either the pump or the automatic equipment. This is an important feature, as it indicates promptly by bell indicator to the substation attendant that something is wrong in the pumphouse. The alarm bell in the substation also operates if the water in the sump becomes too great for the pumps to handle. The substation operator will then call a competent repair man. Detection of trouble is more certain and prompt by this method than by manual operation.

Organization for operation and maintenance of electrical equipment consists of a head electrician and the necessary force at each operation reporting directly to the operating superintendent and indirectly to the head of the central electrical department. This department does all electrical construction and maintains an inspection division to make periodic inspections of the colliery electrical equipment with the district electrician. This affords the inspectors an opportunity to discuss the maintenance of equipment as they find it. Reports of these inspections are furnished to the mechanical superintendent, the electrical engineer, and the operating superintendent.

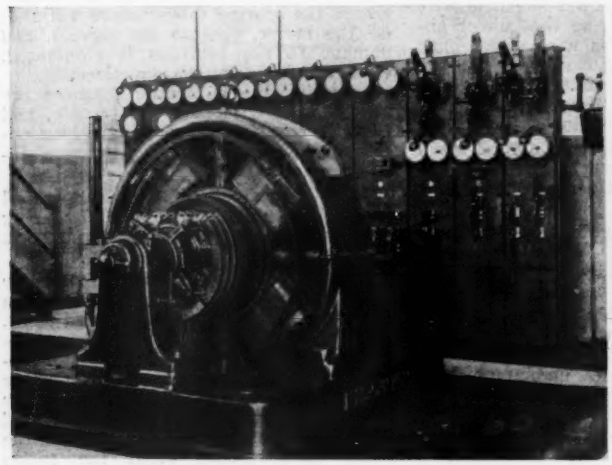
All armatures, field coils, blasting batteries and portable mine lamps are repaired at the central electrical repair shop under the electrical department.

All transmission lines are maintained by the line department, a division of the electrical department.

Electrical operation of coal breakers has the advantage of uniform speed for all cleaning machinery, with greatly increased efficiency and economy over the variable speeds experienced in steam operation.

Metering of power consumed is arranged to secure segregation into the following classifications for cost accounting purposes—transportation, drainage, ventilation, hoisting, breaker machinery, compressed air, lighting and charging stations, miscellaneous.

These meters are read monthly and an itemized state- (*Continued on page* 598)



Panel and rotary converter

Centrifugal pumps, 650-hp. No. 8, 6th Level

Lehigh Navigation Coal Company

SIZING, CLEANING and INSPECTION

J. S. Miller
DIRECTOR OF RESEARCH

DURING the last decade and especially in the last few years of it, great strides have been made in improving preparation of anthracite coal. Such improvement was a natural evolution within the industry reflecting the demand of a more critical market but was hastened by the inroads of substitute fuels as well as by competition among the anthracite producing companies themselves. A change in standards of sizing and impurities has resulted.

The specifications adopted by the Anthracite Institute and now in use follow:

		Testing Screen Mesh	Max. Oversize %	Min. Undersize %	Max. Impurities Slate %	Bone %
Broken	Through	4-7/16	5.0	....	...	...
	Over	3-7/16	...	15.0	2.0	2.0
Egg	Through	3-7/16	5.0	....	...	...
	Over	2-8/16	...	15.0	2.0	3.0
Stove	Through	2-8/16	5.0	....	...	...
	Over	1-9/16	...	15.0	3.0	4.0
Chestnut	Through	1-9/16	3.0	....	...	...
	Over	12/16	...	15.0	4.0	5.0
	Over	11/16	...	10.0	...	...
Pea	Through	24/32	5.0	....	...	...
	Over	16/32	...	10.0	7.5	7.5
Buck	Through	18/32	5.0	....	...	...
	Over	10/32	...	....	...	...
Rice	Through	10/32	...	....	...	...
	Over	6/32	...	....	...	...
Barley	Through	6/32	...	....	...	...
	Over	3/32	...	....	...	...

It should be noted that these are the maximum limits on which coal can be shipped to market and any coal testing within such limits should be a fully acceptable and satisfactory product. Progress in preparation of coal as well as intense competition have caused these to be regarded only as the maximum and practically all coal now marketed is well below these figures, approaching in many cases entire freedom from impurities.

To fully meet all these conditions and properly serve the special trade it has always had, the Lehigh Navigation Coal Company has eight new or modernized breakers capable of handling and preparing five million tons of coal annually on an eight-hour-shift basis. Six of these breakers are situated at adjoining collieries in the eastern end of the Southern Anthracite field; one farther west in this field; the eighth is located in the Middle Coal field at Hazleton.

To constantly improve its product and keep all shipments well within the limits quoted, many developments in sizing and preparation have been worked out. In these breakers, parts, if not the whole, of practically every known device for cleaning anthracite have been installed, not in a chaotic fashion with the hope of stumbling upon a panacea for all ills, but in an orderly manner after a thorough study of proposed changes has indicated a worthwhile improvement.

Details of preparation methods by sizes at this company's breakers follow.

Lump coal, sized over a 6-in. round mesh plate, is hand-picked. After the refuse is removed, the coal is ground to egg size in two stages by passing through successive rolls and is then re-introduced into the smaller material with which it entered the breaker. The rejected material is by-passed to refuse pockets.

Steamboat coal is sized through 6-in. mesh and over 4-6/16-in. mesh plates. At most breakers refuse is eliminated in a special jib of basket type designed for handling this large size material. The coal is ground to egg size and reintroduced into the smaller material with which it entered the breaker. Where steamboat coal is not jigged because of the small percentage of impurities, this refuse is removed by hand-picking. The rejected material, whether removed by jigs or hand-picking, passes directly to refuse pockets.

Broken coal, the next smaller size, is made through 4-6/16-in. and over 3-6/16-in. mesh screens. In former years a considerable tonnage of this size was marketed, chiefly for industrial purposes, but changed methods have cut down demand to such an extent that only one of our smaller breakers now produces it. Like steamboat, broken coal is generally cleaned in a specially designed basket type jig, except at plants where the small impurity content can be removed by hand-picking. The coal is ground to egg size and mixed with the finer material with which it entered the breaker. The impurities removed go directly to the refuse pocket.

Egg coal, the next size in order, is made through 3-6/16-in. and over 2-7/16-in. mesh screens. Changes in burning devices and heating practices have caused a falling off in popular demand for this size, so that at times it is necessary to break down a portion of the egg tonnage to smaller sizes. This size is generally screened separately on reciprocating shakers fed by automatic push feeders, which control the quantity of material delivered and increase the uniformity of sizing. The screened material is fed to the jigs through storage pockets, continuing the uniformity of flow just mentioned. This control of material eliminates undesirable "peaks" and results in a uniformly good market product and minimum loss of good material to the refuse banks. The jigs used in this operation are the basket type, such as Lehigh Valley and Elmore, as well as an overflow type developed by this company. Excellent results are obtained with all. The principal difference between the various types is capacity. Egg coal is also prepared at some breakers by the Chance sand flotation process. Excess egg production can be diverted to rolls and shakers which permit grinding and screening to smaller sizes without returning the product through the breaker, an unnecessary and wasteful operation common to less modern plants.

Chance Cone, Alliance Colliery

Stove coal is sized through 2-7/16-in. and over 1-9/16-in. mesh screens and is treated in the same manner as the egg coal. Objectionable flat material, much of it coal, is segregated and treated separately. Coal of good quality is returned to the market product while material of doubtful appearance is ground to smaller sizes.

Chestnut is made through 1-18/32-in. and over 23/32-in. mesh screens. This size, like stove and egg, is screened and then either jigged, treated in a Chance sand flotation cone or by concentrator tables. In the Chance process, sizing follows cleaning. Very satisfactory results have been obtained on prepared sizes by both jig and sand flotation methods.

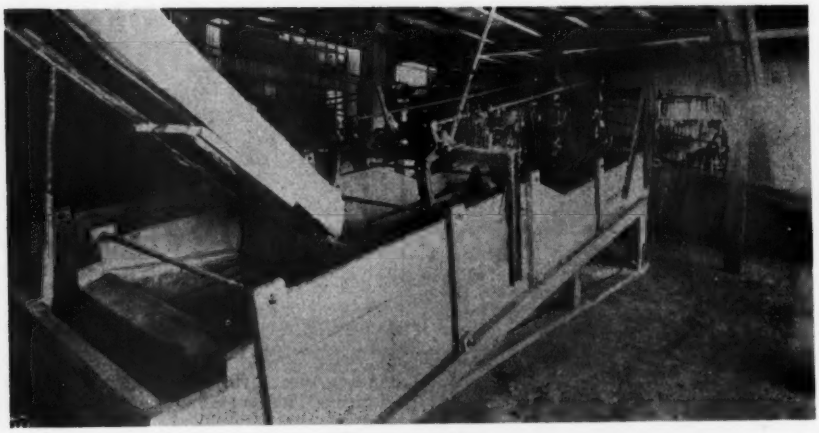
Pea coal is sized through 23/32-in. and over 17/32-in mesh screens. Jigging and Chance cleaning are the processes used in eliminating impurities. Experiments on concentrator table treatment are now under way.

No. 1 buckwheat is sized through 17/32-in. and over 9/32-in mesh screens. Experiments on jigging, tabling and sand flotation cleaning have all been made and this size is being successfully handled by all three processes.

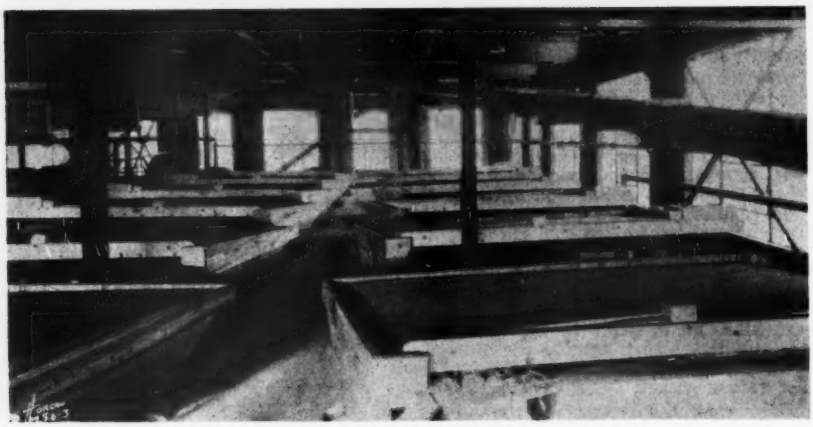
No. 2 buckwheat, or rice, is sized through 9/32-in. and over 11/64-in. mesh screens. This coal is treated by jigging, tabling, Hydrotators, Rheolaveur open launders and Menzie Hydro-Separators. It is sized separately before cleaning. A special low ash product is made at times for various industrial purposes.

No. 3 buckwheat, or barley, is sized through 11/64-in. and over 5/64-in. mesh screens and is treated on tables, Hydrotators and in the Rheo open launder. This size is also prepared to a low ash for specific purposes.

Material smaller than No. 3 buckwheat is treated on concentrator tables. Experiments are also under way on use of the Hydrotator for this purpose.



Door classifiers



Deister concentrators

The rejected material from all these processes is tested by hourly sampling. Control is thus maintained to be certain that production of an excellent market product (the first requisite), does not result in unnecessary waste of good coal in the refuse.

The coal, after being cleaned and sized, is passed into storage pockets. Loading from there is by means of special lowering chutes which place the coal in cars with practically no breakage. Operation is by electric hoist, lowering the chute to the bottom of the railroad car and raising it as the car is filled.

At the completion of this preparation process the coal must pass a rigid examination before it is accepted as a satisfactory product for the market. Each carload must pass a quality and sizing test. Samples in pea and larger are screened to ascertain the percentage of over and under size and hand-picked for slate and bone. Cars are not only rejected for failure to meet the specifications on sizing and impurities but also for such causes as cinders, chips, excessive segregation of fines, too much discoloration, etc., which in the judgment of the inspector affect the marketability of the product even though the quality is excellent. Sizes smaller than pea coal are sampled in the same manner but the test lot, after thorough mixing, is reduced in quantity to approximately five pounds by quartering. After complete drying of all surface moisture, it is reduced in a riffle sampler to about 300 grams. Ash determination is then made by a relative gravity test. A number of samples from each colliery are check-tested daily at the laboratory to assure the accuracy of relative gravity results. Sizing test is made on the portion of the sample not used for quality test.

Complete separation of the inspection force from the operating force is the final assurance of only a uniform high grade product going out to market.

Lehigh Navigation Coal Company

ELECTRICAL FEATURES

(*From page 596*)

ment of the kw. hrs. consumed furnished the auditing department for distribution of charges. No segregation by individual operating units is made here. For example, power consumed by all hoists at an operation is grouped together, as well as at all fans, etc.

Turning to consideration of electric haulage, standard practice had been to use rotary converters with the necessary transformers to obtain the 250 volts direct current, which is standard voltage in these mines. These were installed in main substations and were manually operated. Feeder cables, protected with circuit breakers, were run to each level, except where one cable was sufficient to care for the entire mine haulage load. In mines with several levels and numerous gangways, automatic circuit breakers were installed to minimize interruptions due to failures from any cause along the trolley circuits. In the later installations full automatic synchronous motor generator sets are used instead of the rotary converters. This is done for two reasons: First, improved power factor; second, flexibility to care for extension of haulage system as the mine is developed and it becomes necessary to have the source of direct current power at a more advantageous point. With the automatic equipment, this can be accomplished without the necessity of constant attendance.

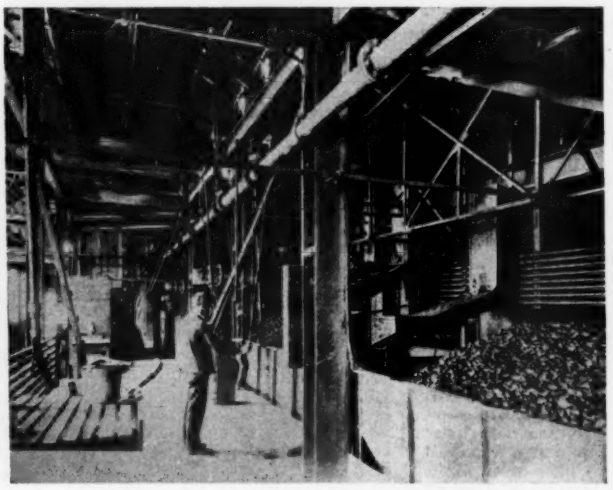
The electric locomotives used are the standard 20, 15 and 8 ton trolley type as well as the 10 and 8 ton standard combination trolley and storage battery and the standard 6-ton straight storage battery locomotive.

The 20, 15 and 10 ton locomotives are used exclusively on main hauls; the 8-ton on feeder-runs in non-gaseous sections, and the 8-ton combination locomotives in gangways where trolley wire can be carried only part way because of gaseous conditions. The straight storage battery locomotives are used in gaseous sections where trolley operation is unsafe.

The experience of this company has proven that electricity is cheaper than steam. This conclusion takes into account not only the cost of electricity per kilowatt hour as against the cost of steam per indicated horsepower developed, but also the consumption of each in delivering a ton of coal on car ready for shipment.

Electrical operation has been condemned by the uninformed as a serious hazard to life and property in coal mining. The hazard of electricity can not be denied, but long experience indicates that it is less hazardous than other types of power.

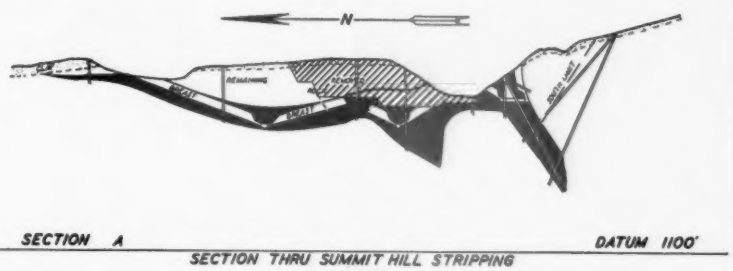
Continuity and dependability of service make electricity the ideal power for the mining industry.



Loading chutes with their hoists, Lansford Colliery

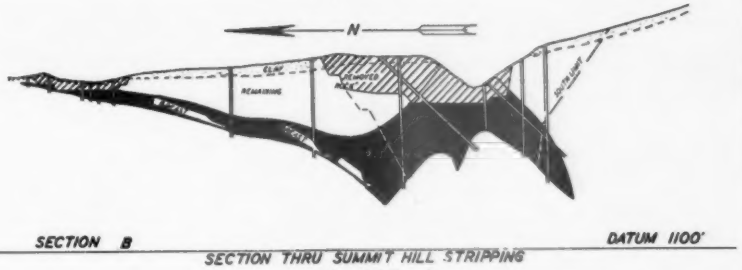
STRIPPINGS

By **S. E. Thorne**
SUPERINTENDENT OF STRIPPINGS



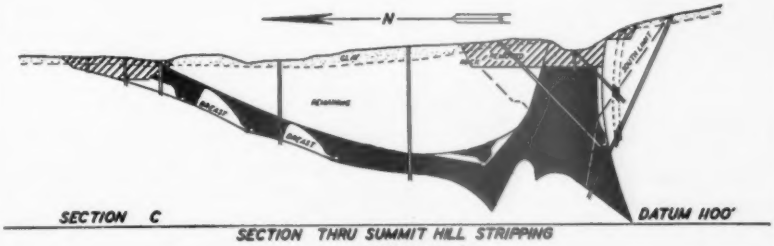
SECTION THRU SUMMIT HILL STRIPPING

FIGURE 1



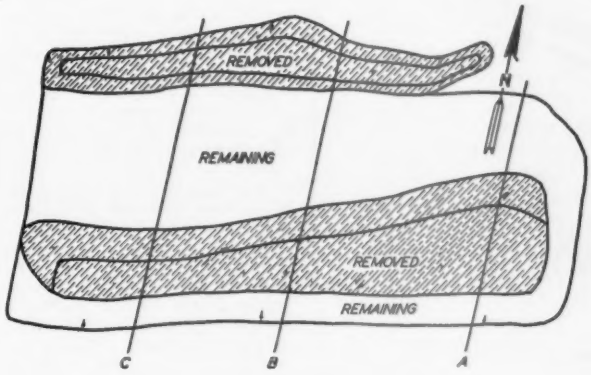
SECTION THRU SUMMIT HILL STRIPPING

FIGURE 2



SECTION THRU SUMMIT HILL STRIPPING

FIGURE 3



PLAN OF BASIN STRIPPING SOUTH OF SUMMIT HILL

FIGURE 4

STRIPPING operations of the Lehigh Navigation Coal Company have been extensive during the past 20 years, and millions of tons of coal have been recovered by this method. It is the oldest method of recovering coal and dates back to the famous Quarry Mines at Summit Hill, about 1820.

Eleven major strippings are being operated from which a total of 4,800,000 marketable tons of coal will have been recovered upon completion.

Stripping in the region consists of removing the overburden from the outcrop of heavy pitching veins; by this method the coal is exposed usually to a depth where the ratio is four yards of overburden to one ton of coal. Anticlinal and synclinal or basin strippings are also being worked.

The Summit Hill Stripping

Typical of the larger jobs with modern equipment is the Summit Hill Stripping in the basin of the Mammouth Vein and covering an area of 5.3 acres. It is 2,300 ft. long and 1,000 ft. wide, the maximum depth of overburden being 200 ft. The normal thickness of the vein on the south dip and in the center of the basin is 45 ft., but on the north dip section, due to irregularities in top and bottom rocks, it is 130 ft. thick. The entire section now being stripped was partly mined by inside methods many years ago. Approximately 40 percent of the coal was won by the inside method, leaving 60 percent available in the present stripping. Actual work was started in 1925 on the south dip of the vein as a proving stripping. Overburden to the extent of 180,000 cu. yds. was removed and 70,000 marketable tons of coal recovered. Under a parting slate, the vein 12 ft. thick was found intact and yielded a very high quality of coal.

Diamond drilling was done as shown in section on *Figures 1, 2* and *3* located as shown on *Figure 4*, and the data obtained from this drilling, coupled with that secured from the old maps, supplied sufficient information to support arguments in favor of making the huge expenditure found necessary. Upon completion of the plans, estimates indicated that removal of 7,350,000 cu. yds. of overburden and breast rock was necessary to win 2,460,000 marketable tons of coal. The ratio of overburden to coal being approximately 3 to 1, the proposition was considered favorable and work was started on a two 8-hour-shift basis.

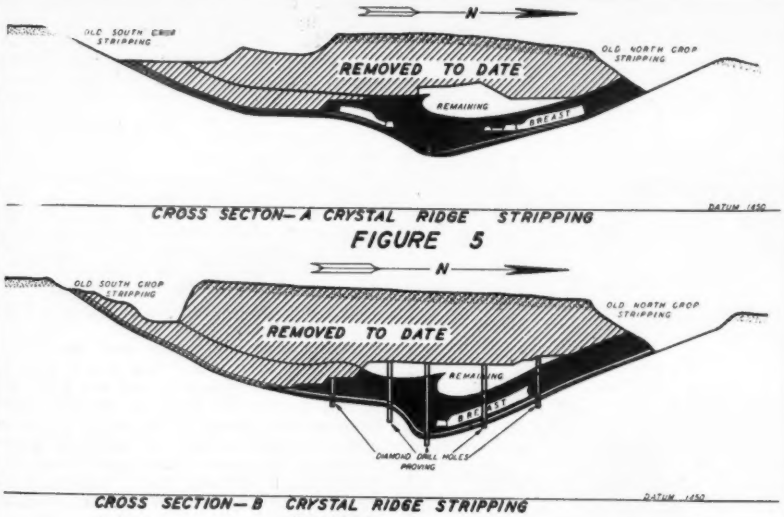
Two 120-B Bucyrus-Erie electric four-yard shovels excavate the rock which is previously drilled by Loomis electric and gas drills and blasted with 40 percent ammonia dynamite. Rock is loaded directly into 30-yd. air dump cars which are hauled to the dump, two miles distant, by five 60-ton Heisler locomotives, in three or four car trips on an ascending grade of 2.6 percent.

Track is laid of 80-lb. rail, standard gauge, with numerous turnouts. A "Y" is used to turn cars and engines when necessary.

The blast drills operate 24 hours per day except on days when blasting is necessary, the drilling crews on these days being used to charge the holes.

Dynamite is received in 50-lb. boxes containing four 12½-lb. bags. Funnels with 6-ft. spouts are placed in the holes which are 5⅝ in. in diameter, and powder is then poured rapidly into funnel, from which it drops to the bottom of the 35-ft. hole and packs around the cordeau and priming cartridge.

Crystal Ridge Stripping—320-B shovel loading into standard gauge 30-yd. cars 48 ft. above bottom of stripping cut

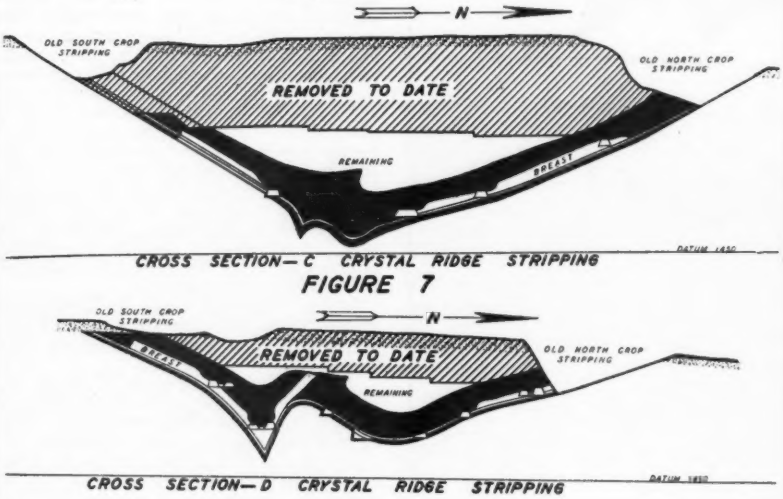


CROSS SECTON—A CRYSTAL RIDGE STRIPPING

FIGURE 5

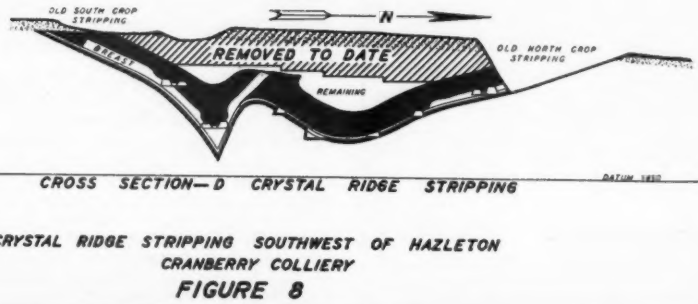
CROSS SECTION—B CRYSTAL RIDGE STRIPPING

FIGURE 6



CROSS SECTION—C CRYSTAL RIDGE STRIPPING

FIGURE 7



CROSS SECTION—D CRYSTAL RIDGE STRIPPING

CRYSTAL RIDGE STRIPPING SOUTHWEST OF HAZLETON
CRANBERRY COLLIERY

FIGURE 8

Blasts consist of 50 to 100 holes, usually 35 ft. deep. At least 15 ft. of tamping is placed in holes to secure the greatest rending power of explosives.

Two major dumps, each 800 ft. long, are maintained and few delays occur due to throwing for new dumping space. Both dumps are over cropfalls caused by former inside mining. Due to the numerous veins outcropping in the Panther Valley, it is very difficult to lay out a large dump without covering the outcrop of one or more veins. In dumping over mined out areas settlement increases considerably. Subsidence on these dumps has required jacking and blocking of track daily; recently it was found necessary to tear out track and rebuild same in original position as the total settlement was 20 ft. over a nine-month period. Dumping operation was then carried out over the top of first dump and very little settlement was noticed.

The cars discharge the load over side of dump, but in about two days the material banks 3 ft. higher than rail of track. A Western spreader car is then used to spread or scatter this material over the side of dump and a Nordberg trackshifter to move the track outward to the edge of dump.

One 70-C Bucyrus steam shovel and one 37 Marion electric shovel load the coal into standard gauge gondolas or hopper cars. Trips of three cars each are handled by two locomotives to a turnout one mile distant. From here trips of 10 cars are moved to the preparation plant two miles away.

To date 1,375,000 cu. yds. of overburden and 200,000 marketable tons of coal have been recovered. The portion stripped and coal recovered to date is indicated on *Figures 1*, *2* and *3*. Due to the great depth of coal on the north dip section, it is planned to recover the coal with a large type dragline excavator, equipped with a 143-ft. boom and a 5-yd. bucket, loading directly into gondolas or hopper cars.

Crystal Ridge Stripping

The Crystal Ridge Stripping is located one mile southwest of Hazleton, Pa., and has been operated since June, 1924. This is in the Eastern Middle Coal Field.

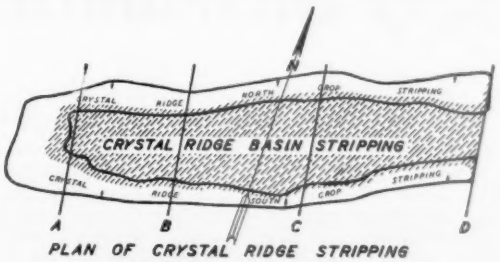
Equipment consists of a 320-B Bucyrus electric full revolving shovel, formerly equipped with a 6-yd. dipper increased to 7½-yd., and a 100-B Bucyrus 3-yd. electric shovel.

Stripping is in a synclinal or basin of the Mammoth Vein previously mined by slopes.

To completely strip the basin will require the removal of 5,200,000 cu. yds. of overburden to a maximum depth of 165 ft. To date 3,190,000 cu. yds. have been removed. The coal to be won will amount to 665,000 marketable tons, of which 95,000 tons have been recovered to date. Excavated and remaining coal and overburden yardage is shown on *Figures 5*, *6*, *7* and *8*. The area being stripped is 2,700 ft. long and 500 ft. wide, *Figure 9*.

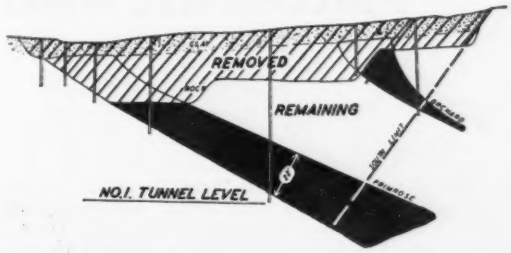
The 320-B shovel is equipped with General Electric direct current, Ward-Leonard generator, field control: This consists of a five-unit motor generator

Lehigh Navigation Coal Company



PLAN OF CRYSTAL RIDGE STRIPPING
SOUTHWEST OF HAZLETON
CRANBERRY COLLIERY

FIGURE 9



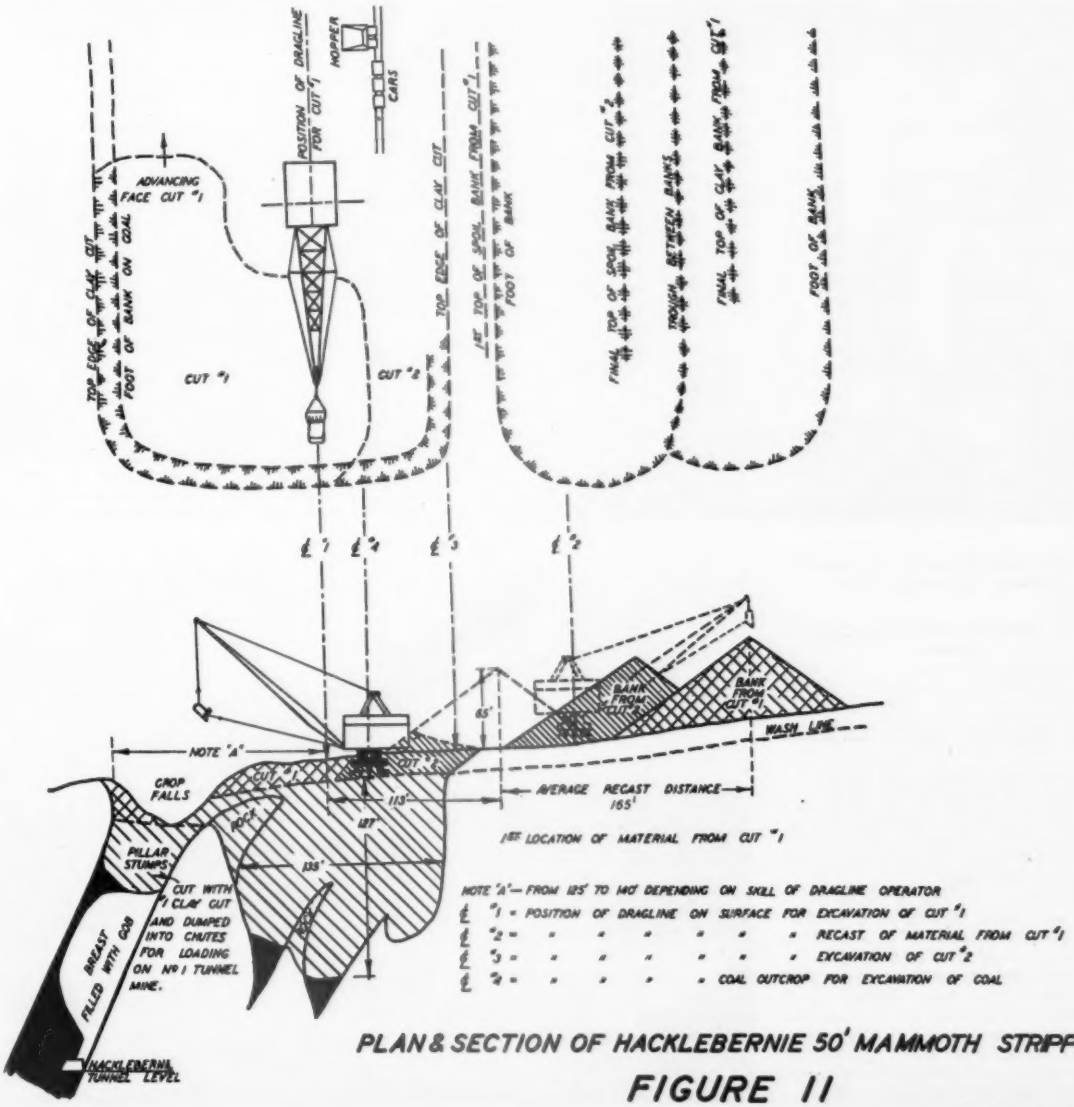
SECTION THRU HELL'S KITCHEN OUTCROP STRIPPING

FIGURE 10

set driven by an alternating-current motor of 2,200 volts. The motor generator set includes three variable voltage direct-current generators, one for each of the hoist, swing and thrust motions, and a constant direct-current exciter. The shovel loads the rock, previously drilled by five Cyclone electric drills and blasted with black powder and 40 percent dynamite, directly into 30-yd. air dumped cars. Trips of two cars each are hauled over a standard gauge track to a dump 5,900 ft. distant by two 42-ton Heisler geared locomotives and four 40-ton Vulcan locomotives. Maximum grade to the dump is 3.5 percent.

The stripping operates on two 8-hour shifts daily.

The 100-B shovel or a smaller type will load practically all of the coal, as the daily production (*Continued on page* 606)


POSITION OF DRAGLINE FOR CUT "1
HOPPER
CARS
ADVANCING FACE CUT "1
TOP EDGE OF CLAY CUT
FOOT OF BANK ON COAL
CUT "1
CUT "2
1ST TOP OF SPOIL BANK FROM CUT "1
FOOT OF BANK
FINAL TOP OF SPOIL BANK FROM CUT "2
TROUGH BETWEEN BANKS
FINAL TOP OF CLAY BANK FROM CUT "1
FOOT OF BANK
BANK FROM CUT "2
BANK FROM CUT "1
WASH LINE
NOTE "A"
CROP FALLS
PILLAR STUMPS
CUT WITH "1 CLAM CUT AND DUMPED INTO CHUTES FOR LOADING ON No 1 TUNNEL MINE.
BREAST FILLED WITH GOB
HACKLEBERNIE TUNNEL LEVEL
AVERAGE RECAST DISTANCE 165'
113'
127'
135'
65'
1ST LOCATION OF MATERIAL FROM CUT "1
NOTE "A"— FROM 125' TO 140' DEPENDING ON SKILL OF DRAGLINE OPERATOR
"1 = POSITION OF DRAGLINE ON SURFACE FOR EXCAVATION OF CUT "1
"2 = " " " " " " RECAST OF MATERIAL FROM CUT "1
"3 = " " " " " " EXCAVATION OF CUT "2
"4 = " " " " COAL OUTCROP FOR EXCAVATION OF COAL

PLAN & SECTION OF HACKLEBERNIE 50' MAMMOTH STRIPPING

FIGURE 11

Lehigh Navigation Coal Company

Material and Supply Distribution

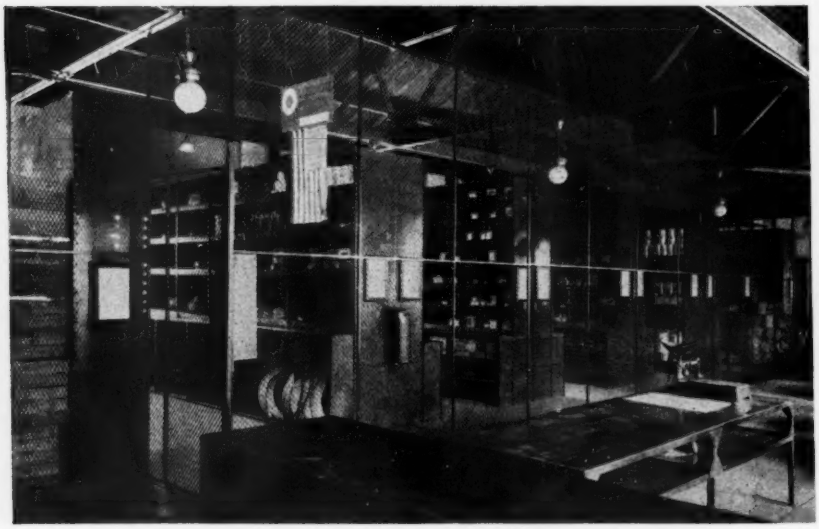
THE function of the Stores Department naturally is to work in conjunction with the operating department, by ordering and maintaining the minimum stock consistent with safe and efficient operation. There is little question that with or without a store department, materials necessary could be had, but to control expenditures and keep the stock within reasonable bounds is the primary object of the Stores Department. To it the management rightfully looks for the maximum efficiency. Such control is of utmost importance when we realize that the foremost authorities recognize 16 percent as a fair average annual charge on material investments.

Stores Department work seems to divide itself into six major divisions, namely:

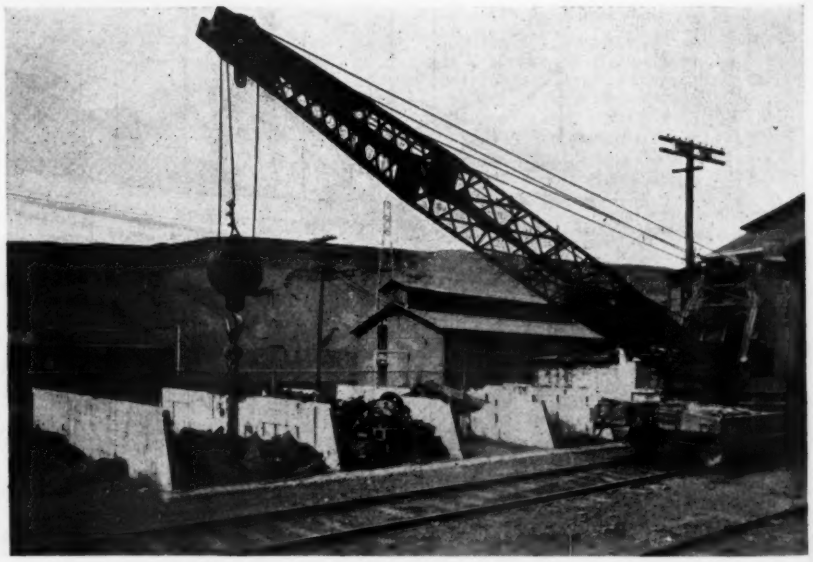
Ordering and receiving materials.
Passing and approval of invoices.
Storage and material distribution.
Transfer and sale of inactive materials.
Accumulating and disposing of scrap.
Material accounting.

Each division, of course, divides itself into many attendant phases which make the store problem what it is today. Two methods mainly used to attain practically the same end are general storehouse and unit storehouse systems. Where part centralization is required, as in our own case, a combination of the two can sometimes be achieved with the best results as regards operating costs and economy. The unit system in our own case has proven the most economical method of controlling supplies and has detracted nothing from any benefits that we may have had under the previous general storehouse system.

In 1921 this company became convinced that the general storehouse was an unnecessary adjunct to the correct functioning of the stores program. A unit storehouse was set up to eliminate duplication of labor and stocks. The plants previously supplied from this central point were placed on their own resources under supervision of a central office in charge of a storehouse inspector. The plan has proven highly successful; a labor force of 60 in the general storehouse offices, warehouses and yards was eliminated and a continual decrease in material stocks was effected, until today it is one-third less than the lowest figure under the former system. It is the present functioning of this system that is presented in the following paragraphs in as short a resume as possible.



Interior view of warehouse showing section of storage bins



Partial view of scrap classification yard

The functions of the storehouse inspector chiefly consist of the following:

Frequent and detailed examination of physical property.

Supervision of storage and material distribution.

Supervision of scrap accumulations and shipments.

Arranging of material consolidations.

Transferring of materials to best advantage.

Inspections of material, especially lumber and timber.

Supervision of local purchases of mine timber.

Supervision of colliery accounting and material distribution.

Maintenance of minimum stocks.

In addition to these duties, the storehouse inspector is in charge of the regular office routine, such as urging materials; adjusting of complaints with shippers; adjusting claims with carriers; shipping of scrap; general correspondence on materials; scrutinizing of requisitions and orders for possible economies and transfers. Various records are maintained to permit the proper follow up of stores control together with a running set of stock figures pertinent to each operation from which frequent and detailed comparisons are made.

In general there are four persons employed at each operation in connection with stores business and accounting. The personnel consists of a storekeeper, ledger clerk, stenographer, and warehouse man. In addition some help is necessary one or two hours each morn-

and Accounting

By **F. R. Edwards**
STOREHOUSE INSPECTOR

ing on the sale of explosives and mine supplies at the different mine openings. The above force, while principally employed on store work, necessarily must devote considerable time to detail in connection with mining work.

The average stock carried at a typical operation is approximately double the monthly average disbursement. Including current monthly receipts, stock turnover averages approximately 34 percent. Main items of material carried in stock and their proportion of the total are:

Machinery and engine gearing	26%
Electrical supplies	12%
Car gearing	6%
Timber and lumber	11%
Rail, sheet steel, etc	5%
Pump parts	4%
Bar iron and steel	3%
Pipe and fittings	4%

Typical colliery office and warehouse combined

Timber storage at one of the smaller plants

Ordering and Receiving Materials

The requisition is the foundation on which the whole stores system rests. Discrimination must be used in ordering what is absolutely essential and in ruling out items not necessary for economical operation, or where advantageous substitution could be made.

The present system necessitates that the person requiring any materials make his wants known to the foreman who, if he approves, requests the storekeeper in charge of supplies to requisition for the material. Requisition is prepared and signed by the storekeeper, approved by the foreman and district superintendent, and forwarded for executive approval. Requisition is routed through the different departments according to the nature of the material; i. e. machinery and mechanical equipment requisitions go to the mechanical superintendent; electrical material requisitions to the electrical engineer, etc., after which they are approved by the general superintendent, and forwarded to the purchasing agent. This method furnishes sufficiently close supervision to eliminate any excess ordering. Stock requisitions originated on initiative of the storekeeper are approved in similar manner.

The purchasing agent upon receipt of requisition, transcribes the item or items to an inquiry form and invites bids from shippers. The order form, later issued, instructs the shipper as to destination and requests that invoice be forwarded to the purchasing agent. Where shippers hold contracts on certain commodities at an agreed price over a stipulated period, the inquiry form is of course unnecessary. Such contracts serve to speed up deliveries and offer a greater assurance of uniform quality. In addition the stock inventories are favorably influenced by dependable deliveries.

Upon receipt, material is carefully checked as to quantity and quality. This information, together with the order and requisition number, is transferred to a tally form subsequently used for checking against material invoice. If shipment or any part of it is rejected for any cause, the invoice is held in abeyance until the matter is taken up through the storehouse inspector's office for transmittal to the purchasing agent and satisfactory adjustment or replacement made. A laboratory is maintained at a central point and all materials requiring an analysis are first passed upon by the chemist.

Light mine timber, ties and some miscellaneous items of lumber are purchased locally through the storehouse inspector's office, principally for the reason that such materials are peculiar to the region in which the operations are located and a closer and more convenient control can be exercised through the local office. The material inspector attached to the office keeps in close contact with this phase of the work and inspects the material periodically. Carload shipments are inspected as received.

Passing of Invoices

Invoices are received by the purchasing agent in triplicate, one copy being retained in that office and the other two forwarded with listing to the general superintendent's office, from where they are routed to the operations receiving the materials. The purchasing agent carefully checks all prices, stamps the invoice with a consecutive number, attaches an apron showing the terms of the invoice, approval of items, etc., before forwarding.

Upon receipt of invoice the storekeeper carefully checks all extensions, compares tally and prepares to pass for payment. Before proceeding with this it is necessary to know that the freight or express bill has been paid and properly receipted, as the original receipted transportation bill is always attached to the original invoice going through for payment and the duplicate to the duplicate invoice for file. In parcel post deliveries postal charges are checked by the stamps affixed to the package.

The storekeeper places his own consecutive number on the invoice, deducts transportation charges according to the terms of the invoice, and makes all neces-

sary alterations to the face of the invoice in keeping with quantities or materials actually received. The net amount due the shipper is then carried to the attached apron for the convenience of the departments concerned, properly signed by the storekeeper and approved by the district superintendent, after which it is forwarded to the comptroller for payment.

Any change on the face of an invoice necessitates the preparation of a special form termed the alteration report. In cases of lumber or timber rejections, this form must be accompanied by a copy of the unloading tally. These reports are forwarded to the storehouse inspector for transmittal to the shippers and purchasing agent.

A draft book is maintained at each of the operations receiving materials and all transportation charges are paid by the storekeeper upon approval and signature of the district superintendent.

A special form is issued by the storekeeper authorizing payment of invoices on discount bills, when necessary to prevent loss of discount. Where this method is not sufficiently prompt the purchasing agent arranges to pay the invoice when received in his office and notes same on the invoice for information of the storekeeper.

Material Distribution

Materials are removed from the warehouses or other storage points on withdrawal orders, signed by the foreman and presented by the persons removing the material. This form also provides space for the classification to be charged.

These orders are then posted in a disbursement book and charged to the proper account. Where materials are stored at different points because of the limited wareroom facilities or because of their bulk or proximity of railroads, it becomes increasingly difficult to be certain that orders are presented for all materials removed and put in use. Trouble in this respect has been largely overcome by insisting that material must not be removed from any storage point unless the withdrawal order is first presented to the storekeeper or in some instances to a designated person located near the storage point, the order eventually reaching the storekeeper. At remote points, where certain materials are used on one class of work, there is substituted for the regular order form a list of such materials on which daily entry is made of the quantities used. This is approved by the foreman and turned over to the office for disbursing at the end of the month.

Check inventories are taken by the storekeeper at varying periods throughout the year, and an annual inventory taken at each operation by the storehouse inspector.

Transfer of Materials and Part Centralization

The principle of unit storekeeping is adhered to except in special instances where it is found more convenient and economical and just as efficient to concentrate special items. This is governed by the activity of the item, accessability to the point where used, value, etc. Continued efforts towards development of better machinery, both as to efficiency and economy, make standardization of machinery difficult in the mining industry.

Where centralization of certain items, such as cement, hoisting cables, etc., is advisable, each storekeeper is notified of the change in source of supply and the storehouse designated to carry is held responsible for maintaining the stock. Some slowly moving items of standard equipment are shipped to one point and divided among several operations closely located, one operation taking the billing and subsequently billing the others their proportionate share.

In emergencies, transfers are made from one operation to another or from the shops. All concerned are alert to the possibilities of utilizing materials which through changes may become obsolete at one operation and still be useful at another. Up to date lists are kept in the storehouse inspector's office and transfers made where examination of requisitions show possible. It is estimated that at least 20 percent of the spare parts carried are slow moving items that offer very little opportunity for transfer, but must be carried to insure safe and efficient operation.

Scrap is classified as gathered at each plant and shipped direct to avoid duplication in handling. All scrap shipments are examined by the material inspector before forwarding to consignee.

Material Accounting

There is maintained at each plant a standard system of accounting. The books and forms in general use are as follows: ordering and receiving book, material ledger, summary account book, disbursement book, sales ledger and appropriation ledger or file. These records are supported by many forms not important enough to treat in a detailed manner and the following description covers only the basic records.

The ordering and receiving book is used by the storekeeper for recording all materials requisitioned. The items are run alphabetically by accounts, each item being written in once for the year and special items added when necessary. Above the horizontal line running from each item, are the months and under each month is sufficient space to permit insertion of quantity, requisition, order, number, date received, and invoice number. This book is a very useful and accessible record that is constantly employed.

The material ledger is the basic record of all materials in stock. This, like the order and receiving book, is a loose leaf record, run alphabetically with materials grouped by accounts. Under each month is shown the balance in quantity and amount carried over from the previous month, receipts for the current month, and disbursements.

A summary account book is maintained into which is entered the total value of the invoices passed daily and totals of all other billing coming into the office. This book is run by accounts and acts as a very efficient check against the individual items balanced in the material ledger each month. The material ledger serves as a check against the actual materials on hand.

In the disbursement book is posted all material used, the pages being grouped by accounts and the cost classifications entered along the side to permit charging out properly. The totals of each classification and account are carried to a grand total. The figures are then transcribed to production sheets and forwarded to the Auditing Department for final entry.

The sales ledger is used in connection with mine supply sales to contractors and employes. A page is devoted to each set of miners or other person purchasing explosives and mine supplies. On top of the page are the names of the purchasers, and underneath are headings to take the date, article purchased, and cost. These sales records are returned daily to the storekeeper by the sales clerk. At the end of the period the charges are totaled and transcribed to the time books against the individual's name for deduction in the Auditing Department.

As the storekeeper does not order materials or equipment for construction jobs, covered by capital appropriation, but instead receives copies of the requisitions issued for such work, by the mechanical superintendent, he necessarily must maintain a separate running file for the checking of such materials upon receipt and the proper payment of invoices. Representatives from the Mechanical, Electrical or Research Departments are available when the storekeeper is in doubt as to the correctness of the materials received.

The repair shop store in addition to carrying certain centralized items for the collieries which are billed to the operations as withdrawn from stock must maintain an accounting system to take care of raw material taken in for manufacturing and later returned as finished product, the items in the meantime acquiring the additional labor costs and overhead and very likely changing their identity entirely. Requisitions for manufactured materials other than those regularly carried in the shop stock are taken over by the Cost Department and the item routed through the different shop departments that will work on the item, the Cost Department obtaining the necessary raw material from the shop storekeeper. Billing in this case is done directly from the Cost Department.

From the summary of materials carried, received, used, etc., during the month at the different operations and shops, a balance sheet is developed which shows the grouping of materials by accounts and carrying the following information: balance on hand, receipts by transfers, receipts by invoices, receipts from transportation charges paid by the storekeeper, to a total of available for use. This followed by disbursements to the operation, transfers out of stock, sales, inventory adjustments and balance on hand at end of month.

These sheets are sent to the storehouse inspector's office for compilation of the entire mining stock. The figures are also used for checking the efficiency of the individual storehouses as to stock carried and turnover. All transfers, receipts, disbursements, balances, etc., are checked by the Auditing Department to whom copies of transfer billing and other necessary information is forwarded. Separate summaries or returns are made by each storekeeper at the end of the month covering amounts paid on drafts for transportation charges and on total paid out on invoices.

Lehigh Navigation Coal Company

Operating staff of The Lehigh Navigation Coal Company

Training of Supervisory Personnel

By **H. S. Gilbertson**

DIRECTOR OF PERSONNEL

THE coal industry is rich in traditions and perhaps no single unit of it any more so than the Lehigh Navigation Coal Company, with its more than 100 years of continuous operation with an unusually static personnel. The traditions which have come down from the early days of anthracite mining are not by any means altogether conducive to the highest efficiency as judged by modern standards in industry.

In determining how far intensive management methods may be applied in the mines we must take account of some rather stubborn facts. The chief of these, for present purposes, is that mining, to a greater extent than almost any other industry, is the domain of the "practical" man. His sphere may be narrowed, but he is indispensable. Doubtless the average foreman is more than two-thirds right in his assumption that mining can not be learned out of books. One probably has actually to handle coal in the veins to understand its geological peculiarities and also to be able to handle the men who handle the coal. It seems hardly necessary to go into detail on this point. There was a time many years ago when the practical man was not only essential, but was the controlling factor in a mining organization. Along in the 70's his limitations became clear and the need recognized of the methods of precision which go with engineering training and methods. Some serious situations arose in keeping straight the boundaries of different mining properties, and in locating the coal in irregular seams. The need for the engineer was accentuated also by a number of serious mine accidents along about this period.

Today the practical man and the trained engineer share the responsibilities, each making his contribution to the industry. One might say that the practical man is contributing art, and the engineer science. In a mining industry there is a good deal of need in many places for more definitely reconciling these two types of men, points of view and methods of working. It would seem that an effort should be made to make the practical man a bit more scientific in his own field, and to make the engineer considerably more practical in many of his relationships.

Making the practical man a bit more scientific would mean, in a word, that somewhat the same point of view and method which is employed in the domain of the engineer would be brought into the practical man's work. That is to say, production or mine operation should become less a matter of traditional methods and more a procedure based upon analysis.

Now the outstanding representative of the practical viewpoint in the mining industry is the mine foreman. In what measure he and his immediate assistants are converted to ways of order and accuracy depends the degree to which real management will permeate the mine organization. Obviously, the desired result can be brought about, if at all, only by some sort of training, either of present foremen or of their successors.

To understand what this means requires a brief description of the human material with which we have to deal in this connection. The mine foreman has much in common with corresponding executives in other industries. He starts out with some rather sharply defined strong points, and a number of weak ones. Among the characteristics in the first category would be included an invaluable fund of experience and knowledge gained in actual contact with coal in its original state. Coupled with this experience and knowledge is an admirable resourcefulness which enables him to meet all sorts of new conditions and emergencies. It is probably true that these conditions are not always met in the best and most economical and effective way, but they are usually met, nevertheless. And because of his experience and knowledge and resourcefulness the successful mine foreman is a leader of men in an uncommon degree.

On the other hand, the typical foreman is not without his weaknesses, and these are due, perhaps, in a major way to the influences which have surrounded him rather than to any inherent qualities in his makeup. Until very recent years the emphasis in anthracite mine operation has been on production, but along with the drumming in of this idea, there has usually been all too little instruction and counsel with reference to the many factors which form the necessary preliminaries to an effective production program. It is not uncommon, for instance, to find a foreman who will permit his rails to get out of alignment, or his roof or timbers to get into a dangerous condition, on the plea that his organization must bend its energies to production, even though some of the other factors are neglected. He is apt not to realize that production is the net result of getting all the conditions in the mine properly established.

Unless he is somewhat unusual, the foreman is likely at times to make his own work unnecessarily hard. He has learned supervision of other men as an art, and the methods which he uses are direct and personal. He has usually not learned the trick of managing large numbers of men by impersonal administration methods. So long as this is the case, he puts a limit upon his own advancement, for there are just so many men who can be handled in a personal way. In short, the foreman characteristically is more of a captain than a gen-

eral. He is likely to spend a great deal of time in the mine in this form of direct supervision, and comparatively little time in the study of his job as a whole, thereby becoming more or less one-sided and one-track minded.

It was with the thought of capitalizing, so to speak, the foreman's strong characteristics and of strengthening his weaknesses that the Lehigh Navigation Coal Company undertook some five or six years ago the program of foreman training. In the term of "foreman" in this connection is included assistant foremen and prospective foremen and assistants.

It was felt that a program of training must first of all have a proper background. In common with most industries and establishments until very recent years, this company had probably neglected to cultivate in the operating supervisory force a constructive attitude, based upon a full understanding of the problems and objectives of the organization as a whole. Furnishing proper background, therefore, was deemed to mean the supplying of a fund of information concerning the company's affairs, in so far as this information had even a remote bearing upon the day's work. To make this point clear, it will perhaps be sufficient to summarize briefly the contents of a printed manual which was furnished to all of the supervisory force under the title of "Mine Management Policies."

In this manual there is a chapter on "Meeting the Company's Problems," which goes into considerable detail with reference to the elements of operating cost, the factors tending to affect total revenue, and the position of the company in the light of conditions prevailing in the coal market during recent years. These problems are stated with a frankness which is perhaps somewhat unusual in the coal industry, if not in any industry. For it is not uncommon, even at the present time, to find organizations in which operating men, carrying large responsibilities, are totally ignorant of these fundamentals of business, and where it is considered even undesirable that these men should be so informed.

The second chapter deals with "Production," detailing the several outstanding conditions which are requisite to maintaining a full and even production schedule. In this chapter we take up such subjects as supply and equipment conditions, mining conditions, personnel conditions and safety conditions.

The chapter on "Safety" undertakes to get at the root of accidents in the mines, what these accidents cost, both directly and indirectly, and what basic conditions must be set up in order to prevent their recurrence.

A chapter on "Costs" deals frankly but simply with the functions of business, such as invested capital, revenue and expense. The foreman is shown how operating costs are figured, and then is let into some of the secrets of general expenses, such as taxes, insurance, depreciation, obsolescence and depletion. There follow some directions for the practical man with reference to the effective methods of controlling costs.

A discussion of "Supplies and Equipment" deals with some of the fundamentals of economic use of materials.

A chapter on "Organization from the Foreman Down" undertakes to give some directions and advice with reference to some of the more obvious principles of organization with a view particularly to aiding the foreman to strengthen his executive methods.

"Organization from the Foreman Up" is the title of a chapter largely descriptive of the line and staff organization of the colliery, and of the organization as a whole and of the foreman's relation to it.

The chapter on "Handling of Men" undertakes to relate the human problem in mining to production, costs and safety, and goes into the subject of the selection and organization of men, their instruction, and discipline, and the handling of grievances.

Under "Company Good Will" an effort is made to impress the foreman in numerous specific ways with the importance of contributing his part toward establishing favorable public relations.

A final chapter is one on "Self-Management," the object of which is to help the foreman to organize his work in a systematic manner.

With this manual as a starting point, the company organized foreman training classes during the long strike of 1925-26, and beginning with discussion groups at the collieries, took up systematic discussion of questions prepared and submitted by the Personnel Department. Ever since that time a course covering the general scope of the publication heretofore referred to has been conducted for a six-month period during the winter. The method each year has been varied somewhat. One of the difficulties in maintaining a successful and interesting program of foreman training consists in developing a fresh point of view each time the same old subjects are gone over. Attendance at these courses has always been voluntary, and it is gratifying to record that each year the attendance has shown an increase over the previous one.

Among the many more or less standardized procedures that, for lack of better classification, are associated with "personnel work," there are few undertakings that yield more gratifying results than foreman training. One must think of it, however, not altogether in terms of any special device or systematic effort, such as a series of meetings, but rather of the total of the influences which the company causes to surround operating men in position of authority.

It would be somewhat difficult to measure or to relate specific results which have been obtained through our program. One obtains the impression, however, that the work has been successful when he finds a foreman or assistant foreman stepping out ever so little from the traditional guesswork methods which are apt to be characteristic of the practically trained man, and figuring out his problems somewhat after the manner of a trained engineer. This has been noted in a number of instances. It is due perhaps in some degree to this systematic effort at foreman training that the safety record of the company has been improved as much as it has during these recent years. And there is certainly better general understanding of the handling of men in some very difficult situations. And there is a greater unity of policy and method throughout the organization than was formerly the case. We sometimes speak to our foremen of the importance of being "organization men." We believe that, as a result of the foreman training effort, there is more of the organization spirit than formerly.

STRIPPINGS (*From page 601*)

of the large shovel would exceed the breaker capacity.

Hell's Kitchen Stripping

A typical job using small equipment is Hell's Kitchen Stripping located at Nesquehoning, an outcrop stripping on the Primrose Vein.

Two 70-C Bucyrus steam shovels with caterpillar traction are in use excavating both overburden and coal. A Western spreader car and Nordberg trackshifter are used.

Overburden is hauled from pit on an ascending grade of 3 percent by 20-ton locomotives and 4-yd. side dump cars of 36-in. gauge. Mine cars used to transport coal to the preparation plant are 42-in. gauge. The difference in gauge was overcome by placing a third rail in the track and using crossovers and frogs built in the local machine shops of the company and are a combination rail and plate frog. In order to use this type of frog, the old style stub switch had to be used.

Drilling and blasting of rock is similar to the method employed at the Summit Hill Stripping. Two Loomis gasoline blast hole drills are used. Wet ground conditions make it advisable to blast with 40 percent gelatine dynamite in 4-in. x 16-in. cartridges. Cordeau is the detonator used.

Approximately 1,300,000 cu. yds. overburden will have been removed upon completion of present plans, and 514,000 marketable tons of coal recovered.

To date 590,000 cu. yds. overburden have been removed and 150,000 marketable tons of coal loaded, prepared and shipped to market.

The typical cross-section, *Figure 10*, indicates the method of removing overburden and coal.

The object of most outcrop strippings is to prevent clay and rock from mixing with coal when the vein is mined by inside methods. The Hell's Kitchen Stripping, while an outcrop stripping, shows a ratio of 2.5 yds. of overburden to one ton of coal and therefore the ultimate cost per ton will be low.

Hacklebernie and Mammoth Stripping

A typical dragline excavator job is the Hacklebernie 28-ft. and 50-ft. Mammoth Stripping situated at Nesquehoning, in the extreme east end of the Mammoth measures of the Southern field. The excavation of overburden and coal is accomplished by means of a 175-B Bucyrus dragline excavator, electrically operated and equipped with a 3½-yd. bucket. Overburden which consists for the most part of clay and gravel, is removed from pit and deposited at right angles to the strike of vein stripped. This method causes a conical pile to be formed; where a second cut is necessary to remove spoil from the pit, the first spoil bank is recast by the dragline as shown in the accompanying sketch, *Figure 11*.

On the section already completed when the spoil material was removed and the 50-ft. vein exposed, the dragline was moved into the pit on a 10 percent descending grade. Snub or guy ropes are used as a safety measure while the machine is descending heavy grades.

The dragline bucket discharged the coal into a 70-ton capacity, specially designed hopper, equipped with two loading chutes and air operated gates. From this hopper coal was loaded into mine cars and taken to the preparation plant by 38-ton locomotives hauling 45-car trips.

Lehigh Navigation Coal Company

Standard safety poster board

Interior view of underground mine hospital

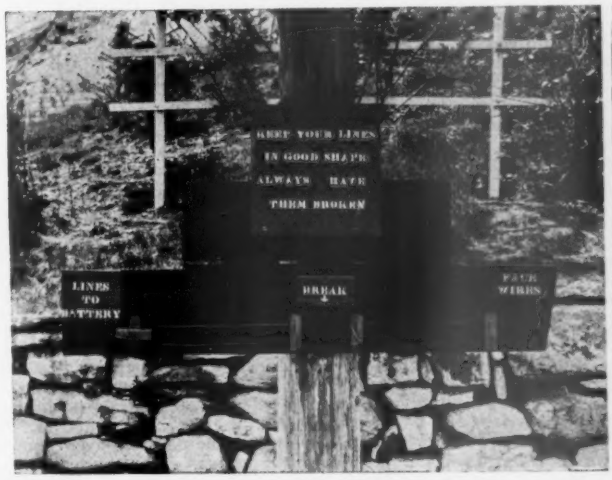
ACCIDENT PREVENTION, First-Aid and Mine Rescue

By **T. D. Thomas**
MINE INSPECTOR

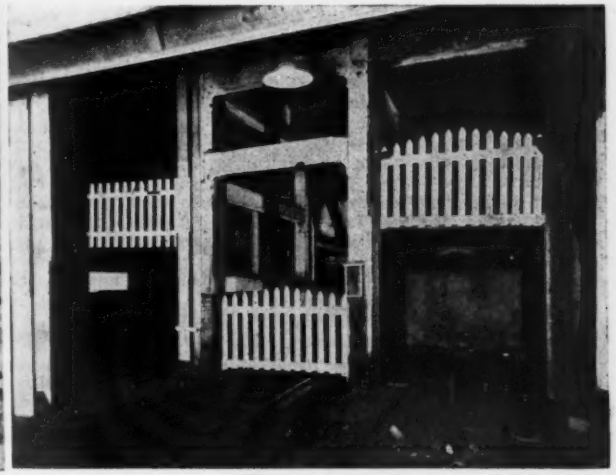
and **H. J. Seitzinger**
SAFETY ENGINEER

THE mines of the Lehigh Navigation Coal Company, especially in the Panther Creek Valley, are subject to nearly all of the usual hazards of coal mines, plus additional hazards associated with steep pitching veins. This peculiar formation of the coal lends itself to rushes of coal and rock, which require constant vigilance to prevent frequent and serious accidents. Without vigilant and constant attention to ventilation measures also, the mines would be subject to numerous gas explosions. For, in such seams, there is always the danger of sudden liberations of gas in great quantities in case a breast were to run.

These special conditions have intensified the interest of the company in accident prevention, and with good results, considering all circumstances. For in recent years this company, as measured by the very definite yardstick of fatalities, has had a much better record than is shown by the average of the whole anthracite industry, for in the years 1924 to 1929, inclusive, the average number of fatalities in the industry per million man-days worked was 12.79 as against 12.55 fatalities for the Lehigh Navigation Coal Company. During this



Standard method for installing electric blasting wires



Automatic safety gates, intermediate landing

same period, the industry as a whole produced 168,318 tons per fatality, whereas this company produced 208,890 tons on the same basis.

The management believes that the accident problem should be attacked from every angle which offers a promise of results. Roughly speaking, its efforts in accident prevention may be grouped into two classes: *first*, the physical measures, and, *second*, the personal or human measures.

Taking, for instance, the question of preventing gas explosions. The obvious physical line of attack, of course, is by way of adequate and continuous ventilation at all points where men work. The fan, being the mainspring of ventilation, should be the best type obtainable and should be thoroughly and regularly inspected. To what extent the company lives up to this standard is evidenced, first, by the specifications for this kind of equipment. It is required, of course, that the fan in all its parts, wherever possible, be built of incombustible material; secondly, that all electrically-driven fans be equipped with automatic starters, remote control, special recording gauges, volt meter, ampere meter, thermostant control, and explosion doors.

Proper ventilation is also related to proper methods in mining and operating. It is a standard requirement of the company that all airways be kept large and clean; that air shall not pass through gob workings to new workings. The system of overcasts, at every fourth breast, which for lack of space are not here described, is designed to reduce friction by frequent splitting. It also makes possible the elimination of doors on haulageways and prevents short circuiting of air while loading is going on at the chute. All return air is kept above the haulageway; so that in case of an explosion its effect is localized and the quantity of air required for each split can be obtained by adjusting the regulator in the overcast. The introduction of this system has made it possible to reduce very materially the number of auxiliary fans.

In the realization of the importance of good ventilation in the prevention of accidents, detailed ventilation maps are being introduced at several of the mines, and every encouragement is given to the operating men to eliminate guesswork with respect to the quantity of air furnished on the various splits. These maps aid the district superintendent by keeping the ventilation situation constantly before him, so that he can note any decrease in the volume of air and make necessary corrections.

Another important factor in the prevention of gas explosions has been the introduction of electric cap lamps and flame safety lamps. Open lights have been practically eliminated in the company's mines.

Much attention has also been given to explosives. Permissible explosives are used in all the mines. Firing by fuse has given place to electric firing batteries.

The introduction of electric firing devices, as well as electric haulage, has introduced new hazards and consequently calls for new safety precautions. Premature shots sometimes occur as the result of "stray currents" coming in contact with lead wires. Miners sometimes attach their batteries to the wrong wires, and sometimes they have fired from trolley wires. The result of this bad practice is often disastrous.

There is, of course, a limit to what can be done by purely physical measures; the personal factor is of equal or even greater importance. Hence the efforts of the company to acquaint both its complete supervisory force and miners with all the hazards of mining, and the part each of them should play in minimizing them. This educative work takes several forms, but perhaps the most effective is the personal instruction of individual miners at the hands of his immediate superior. It is the aim of the management, so far as possible, to convey as much practical information concerning the use of explosives, control of ventilation, etc., as it is possible to do. Every miner is given a handbook of safety rules, which at least places the company's policy before the miner. The effects of this education reveal themselves gradually, but, it is believed, surely.

Publicity work of a more general sort in the interests of safety is illustrated by safety slogan contests and safety bulletin boards. These contests have aroused a very considerable interest among the men, and, while the results obtained are far from measurable, nevertheless they are believed to be potent in creating what might be termed a safety public opinion or point of view.

When all that seems possible has been done to prevent accidents, and the effort has failed, the next best move, in the company's opinion, is to make a thorough study of each accident of any considerable severity. Such accidents are thoroughly investigated by the company mine inspector and the colliery officials, often in company of the state mine inspector for the district. A report of this inspection is placed in the hands of all colliery superintendents, and in many instances the report and the accident of which it is the subject is made the occasion of a special discussion at a meeting of the operating officials.

Much the same procedure as is followed in the mines is employed in the breakers and other outside operations. In this department the number and severity accidents is considerably less than on the inside.

First Aid and Mine Rescue

Despite all efforts of a physical and personal nature to eliminate the hazards of the mines, many lives were formerly needlessly sacrificed in the mining industry by the improper treatment administered to injured persons. This condition has been radically improved by the installation of first aid and mine rescue training.

The credit for first realizing the importance of these humane procedures seems to belong to the late Dr. George H. Halberstadt, a well-known physician and surgeon of Pottsville, Pa. Dr. Halberstadt organized and instructed the original crews in first-aid work. As our operations are in the southern anthracite field and ajacent to the scene of Dr. Halberstadt's labors, the benefits of first-aid training became known at an early date, and it was introduced into this field about 1907.

Increased interest became manifest in first-aid work after many disastrous mine explosions occurred in the United States. The Bureau of Mines Corps No. 1 was stationed at our mines for a certain period in 1910, when instructions in first aid and mine rescue were given to a select group of our employes. Dr. J. H. Young, chief surgeon, was put in charge of the work, assisted by a safety engineer. Twenty-five first-aid teams were organized and instructed during the year. Competition between the various teams was keen, as the best drilled team was to be sent to the first demonstration conducted by the Bureau of Mines in Fittsburgh in 1911. At this demonstration were many notable persons, including President Taft and Clara Barton, famous war nurse. The team representing this company in first-aid work won first prize.

To maintain a high degree of efficiency in first-aid work annual outings are held at which the first-aid teams compete to determine the proficiency in the work. Appropriate prizes are awarded to the winning teams.

First-aid work is not compulsory on the part of the employe. The training is under the supervision of the chief surgeon and the safety engineer. The Bureau of Mines manual for first-aid instruction for miners is the standard adopted. Certificates of competency are issued by the Bureau of Mines to all first-aid men who qualify. It is appropriate to say here that the services rendered by the Bureau of Mines are highly appreciated.

First-aid hospitals are located on all levels. The employes of the various collieries were desirous of having the best equipped hospitals and much interest was aroused. The employes made contributions and solicited the whereabouts for contributions, so that the equipment was of the best. An official of the Bureau of Mines pronounced Coaldale Colliery Third Level Hospital the best equipped mine hospital he has seen. (See illustration.)

A central mine rescue station is maintained at Lansford for the comany's Panther Valley operations. Additional stations are located at Alliance and Cranberry Collieries, which are distant from the main operations. Fifteen sets of two-hour self-contained oxygen breathing apparatus and 18 gas masks of the two-hour type are distributed among the three stations. Selected groups of employes from each mine are kept in training to cope with any emergency that may arise.

PRODUCTION OF PYRITES IN 1929

The production of pyrites in 1929 amounted to 333,465 long tons, valued at $1,250,141, according to the Bureau of Mines, compared with 312,815 tons, valued at $1,081,758, in 1928, and 302,826 tons, valued at $1,075,644, in 1927. These figures include by-product pyrite and pyrrhotite concentrates from Tennessee and partly desulphurized tailings from zinc operations in Wisconsin.

As in previous years, pyrites was produced in California and Virginia.

The quantity of pyrites sold or consumed by producing companies totaled 336,456 tons in 1929, 310,250 tons in 1928, and 293,764 tons in 1927. In 1929 the pyrites produced contained approximately 120,371 tons of sulphur; in 1928, 113,305 tons; and in 1927, 113,406 tons.

Imports of pyrites in 1929 showed an increase of 13 percent in quantity, following an increase of 82 percent in 1928, and were 514,336 tons, valued at $1,507,640. compared with 457,123 tons, valued at $1,135,463, in 1928. The imports for 1929 are larger than in any year since 1917. Of the quantity imported in 1929. Spain furnished 446,093 tons and Canada 68,243 tons.

Lehigh Navigation Coal Company

Compensation and Medical Departments

By **F. S. Riordan**
COMPENSATION ADJUSTER

and

Dr. R. H. Kistler
CHIEF SURGEON

THE hazard inherent in mining of coal develops many accidents. While many of them are trivial, there are always enough serious ones to cause extended idleness and suffering. For a long time injured employes had no relief. Having to pay for medical treatment as well as losing their income during these forced periods of idleness worked hardships. In cases of fatal accidents many times whole families left without support became public charities. Serious thought was given to this condition, and about 1883 a plan designed to relieve the situation was formulated. The men were to pay a small percentage of their wages monthly, the amount contributed by the men (purely voluntary) was to be equalled by the company and placed in a fund known as "The Beneficial Fund." Out of this money an injured employe was paid 50 percent of his wages, with a maximum of $50 per month during his incapacity, not to be longer than six months in case of injury and 18 months to dependents in case of fatal accident. The company furnished the necessary clerical work. A board of trustees, giving representation to both parties, was appointed and started functioning in 1884. For more than 30 years this plan was in operation, going out of existence with the advent of the present workmen's compensation law, January 1, 1916.

The experience gained in this period made the transition from the beneficial system to the present plan of handling compensation cases comparatively easy.

The records, while far from being as complete as at present, gave sufficient data to lay the foundation of our compensation program and start it without confusion. In fact, the method of handling compensation cases outlined in 1916 was so complete that it is still working admirably, very few changes in the original plan having been necessary.

The company carries its own compensation liability, being one of the many self-insurers in the state. It does this for two reasns: First, it is cheaper, as the insurance rates on mining risks are higher than in other industries; secondly, it requires personal contact with the injured employes and assures a just and liberal handling of each individual case. That it works well is evident from the relations existing between the men and the company in compensation matters. Labor leaders concede that our handling of claims is all that could be desired. Few cases are contested, and those that are leave no ill feeling, as the reason for contesting is always apparent and generally sound.

Everything possible is done to make things easy for an injured employe to get his payments without delay. In case of fatal accidents, where possible, the money is taken to the homes semimonthly. It is also taken to the hospital regularly for those seriously injured. This service is much appreciated and has aided materially in perpetuating the good feeling between employer and employe.

The medical service is the best that can be obtained, and the matter of expense is never considered when the comfort and welfare of an injured employe is at stake.

Organization of these related departments is illustrated by the accompanying chart.

The medical and compensation departments are housed in one building, with the exception of the hospital and assistant surgeons. This arrangement saves duplication of records and permits close contact between the chief surgeon and adjuster in the discussion and disposal of all compensation cases.

The employment office, while not a part of the compensation department, is housed in the same building, so that when men are hired, they may be sent at once to the chief surgeon for physical examination before being finally accepted or rejected for employment.

Each colliery has several first-aid teams to give prompt attention to the injured before being sent to one of the company's surgeons or to the hospital.

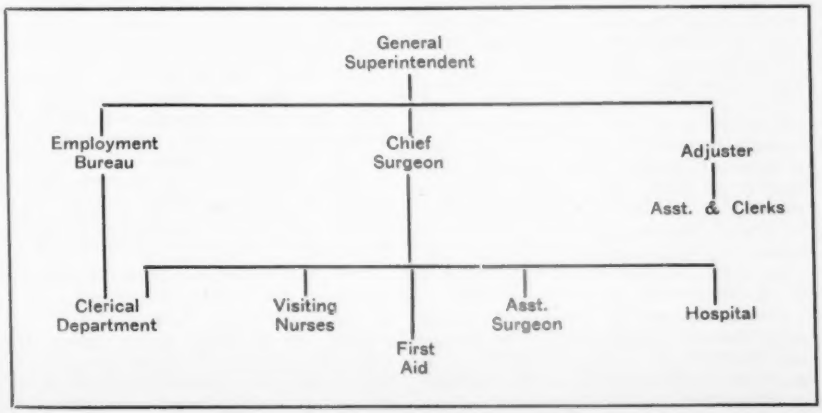
Two nurses are employed, one constantly in the chief surgeon's office and one for community welfare work.

The assistant surgeons are located in the towns adjacent to the collieries. They are on a fixed salary. They treat all except serious accidents and render regular reports to the chief surgeon, who approves and forwards them to the adjuster's office.

All serious cases are sent to the hospital in one of the several company ambulances, which are kept in constant readiness for emergencies.

The chief surgeon supervises the treatment given by the company surgeon and the hospital, and receives from them periodic reports on the condition of the patients under their care. At times, he makes personal visits so as to closely follow up the patients' convalescence and to see that they are returned to work promptly upon recovery.

The comany has established an exceptional record for prompt filing of accident reports and agreements with injured employes with the state department; also in the adjudication of questionable claims without resource to the referee and compensation board.



SPECIFIC SURFACE REACTION RATE OF PURE CARBON IN AIR

The specific surface reaction rate of pure carbon in air has been measured with remarkable reproducibility by scientific workers of the Pittsburgh Experiment Station of the Bureau of Mines and of the Carnegie Institute of Technology. This information is important in the burning of solid fuels such as coal and coke. Fundamental information on this chemical reaction has been difficult to obtain because of the difficulty of adequately controlling the important factors of oxygen concentration, area of reacting surface, and surface temperature. When a piece of carbon starts to burn vigorously the surface area changes rapidly, the surface temperature quickly gets out of hand and the concentration of available oxygen rapidly decreases. And, as is often remarked in scientific work, unless all influencing factors are not either known at all times or kept constant, fundamental information can not be obtained. The new method involves bringing accurately shaped and weighed spheres of carbon to a known temperature in an inert gas, suddenly blasting the particle with an air stream of known velocity and temperature for a very short interval, quickly quenching the particle in inert gas, again weighing to determine the amount of reaction, and obtaining careful records of the particle surface temperature during the combustion. The results are highly reproducible and should be of real value in the design and control of coal- and coke-burning installations.

At 48 strategic points on Lehigh Navigation coal lands these poster boards present the forest fire prevention thought through slogans which are changed weekly

Developments in Forestry

By **A. C. Neumuller**

FORESTER

OVER 93 years ago Josiah White, chairman of the Executive Committee of the Lehigh Coal and Navigation Company, received a letter, the following of which is an extract:

PHILADELPHIA, *December* 23, 1837.

To JOSIAH WHITE, *Chairman of the Ex. Com. of the Lehigh Coal and Navigation Company:*

I have received your letter of yesterday's date, and in reply am authorized to state that the terms offered for timber are accepted, the same to apply to the timber already cut as well as that which may be hereafter cut for the use of the company's work; *Provided,* that there shall be included in the measurements the top portion of trees large enough for cross pieces or other parts of the railway or other works, *as the writer of this has seen much destruction of valuable timber by large trees being felled and only a single log taken from it near the stump.*

I am, very respectfully,
ELI J. PRICE, *for*
Lord Ashburton and
John Hare Powel.

The above letter is probably the oldest writing on the subject of forest conservation in the possession of our company. It is interesting because it shows the early interest taken by the company in forestry matters.

The forest conservation spirit of the fathers of this organization seems to have been handed down to following generations, for we find that in 1902 our company played a leading part in the founding of the Pocono Protective Fire Association, probably the first forest protection association in North America.

That same interest in forestry is displayed again when in 1906 this company sent the superintendent of its Monroe County lands to the Yale Forest School at Milford, Pa. This action resulted in the first steps toward the education of the natives and summer residents of the Poconos in the prevention of forest fires and has culminated in preserving one of the greatest vacation lands of the state.

This same interest in forest protection resulted in the employment, in the fall of 1913, of the present forester.

This corporation and other anthracite corporations, like the Government, are long-lived organizations and must anticipate their timber needs for many years.

Briefly, our forest problem is one of forest protection. Situated in the Weiser Forest District, that part of Pennsylvania known as the worst forest-fire district in the state, probably due to its vast network of hundreds of miles of heavily graded railroads and inhabited by a people then indifferent to the destruction by fire of forests of the coal companies' lands, it is easily realized how this company alone could have a burned-over area of 15,000 acres in the spring of 1913.

It was realized that forest protection must precede any other activities for the improvement of forest conditions. It would be foolish to conduct reforestation or silvicultural operations as long as fires were permitted to destroy any investment of this nature. It was also realized that forest protection could not be practiced successfully by merely extinguishing those fires that were bound to occur by negligence and utter lack of responsibility on the part of the owners of railroads (our own included), and carelessness and thoughtlessness on the part of the inhabitants of this region. The mental attitude of almost everybody was such that a complete change of heart was necessary. Our problem was one in which we must secure a complete change of mind, a mental attitude that would not permit the annual burning of our forests. To accomplish these ends, our company inaugurated an intensive educational campaign that would reach every man, woman, and child living within the limits of its wooded areas.

School children were interested by forest essay, forest-fire slogan, and forest camera contests. The school pupils of the largest towns became intensely interested when, under the direction of the company's forester, they actually established small forest tree plantations on the company's lands along the highways.

The forest-fire-prevention thought is presented to the transient and tourist by large 8-ft. by 11-ft. poster boards erected at strategic points along the highways. Forest-fire slogans are posted weekly on these poster boards, and the autoist generally becomes converted to

Part of Lansford High School Forest Plantation, planted under direction of company Forester on Arbor Day, 1923

Natural reproduction of pitch pine on company lands. Note dense under story of young pine

our forest conservation through such pithy expressions as the following:

"A Burning Forest Is a Burning Shame—Remember the Ember."

"A Cigarette May Be Down but Not Out—Save the Forests."

"The Time to Put a Fire Out Is Before You Drop the Match."

"This Is God's Country—Don't Set It on Fire and Make It Look Like Hell."

"The Best Time to Stop Starting Fires Is *Now*—Be a Hero; Not a Nero."

"Forest Fire Prevention Is Not a Science, It Is Just Common Sense Safety Ever—Fires Never."

"Smokers! Spare These Trees!"

"Cigarettes Are Irresponsible—Don't Let Them Go Out Alone. Park Your Sparks Carefully."

"Matches Out Leave No Doubt."

To prevent fires occurring along the company's narrow-gauge railroads traversing wooded areas, the Forestry Department annually burns approximately 20 miles of safety strips. These safety strips parallel the railroads and average 300 ft. in width. Cooperating with the company are the Central Railroad of New Jersey, the Lehigh and New England Railroad Company, the East Penn Electric Company, and the Pennsylvania Power and Light Company. All these corporations burn safety strips along their rights of way and lend assistance in many ways in the elimination of fire hazards.

Some idea of the progress made in forest protection is gained from the accompanying tabulation.

"Fire Is Rare When Care Is There"

	1913	1916	1929
Number of fires	68	165	12
Area burned	15,000 acres	517 acres	64 acres
Cost of extinction	$1,912.70	$349.00	$128.45
Average area per fire	221.59 acres	3.13 acres	5.33 acres
Average cost per fire	$28.13	$6.09	$10.70

We realize that all forest fires can not be eliminated by education and removal of fire hazards. To extinguish the fires that seem bound to occur, the company maintains a trained force of 12 fire fighters equipped with a motor truck, fire pumps, and other modern fire-fighting apparatus. This force of men is augmented with fire crews at each of its collieries. The colliery fire crews are made up of men regularly employed at the colliery who can be spared from their regular duties to extinguish any fires occurring in the vicinity of the colliery.

In 1916, previous to our educational activities and safety-strip burning, we had 165 fires, 106 of which were caused by locomotive sparks. In 1924, and since that date, not a single forest fire has resulted from this cause.

It was a common occurrence to see the skies illuminated at night by large forest fires on company lands up until 1920. Today such scenes are rare.

The Lehigh Navigation Coal Company has demonstrated to its employes and all the people inhabiting this region its ability to eliminate forest fires caused by its own agencies, and the people in turn have demonstrated their love for the woodlands and their appreciation of the company's efforts by being careful with fire in the woods.

With the improvement of forest protection conditions came an improvement in forest growing conditions. The company's watersheds, maintained for the supply of commercial and domestic water, have gradually increased in value; natural reproduction has set in on lands which will, in the near future, assist materially in the supply of small mine props and ties for mine purposes.

The company firmly believes that planting is essential for continued forest production on lands that preclude natural reproduction. There is, however, a small percentage of company lands where natural reproduction is unsatisfactory. Conifers are used because they thrive better than hardwoods under adverse conditions.

The woodland holdings of this company are at present not sufficient to produce a supply of mine timber adequate for its needs, and can never hope to depend entirely on its own lands for a complete timber supply. With continued success in forest protection, reforestation and cutting methods now in force, the future will see large areas of active working forest areas that will aid materially towards its mine-timber needs.

Lehigh Navigation Coal Company

COAL-MINE FATALITIES IN MAY

Accidents in coal mines in the United States in May caused the death of 138 men, according to information received from state mine inspectors by the United States Bureau of Mines. Of this number 107 deaths occurred in bituminous mines in various states and the remaining 31 were in the anthracite mines of Pennsylvania. The death rate per million tons of coal produced during the month was 3.29, based on an output of 41,901,000 tons of coal; that for bituminous mines alone was 2.98, with a production of 35,954,000 tons; and for anthracite mines a death rate of 5.21 was shown, based on a production of 5,947,000 tons. The number of deaths and the death rates per million tons produced in May indicated a better record than that for the preceding month of April. As compared with May, 1929, the record for May of the present year showed practically no change in the death rates, because, while the number of fatalities was reduced, the production of coal also fell off in the same proportion, with the result that the death rates were about the same as in May last year.

The death rates for May, 1929, were 2.97 for bituminous mines, based on 121 fatalities and 40,706,000 tons of coal; 5.23 for anthracite, based on 33 deaths and 6,308,000 tons; and 3.28 for the total industry, with 154 deaths and 47,014,000 tons.

There were no major disasters during May—that is, there was no disaster in which five or more lives were lost—but there were seven major disasters during the preceding months of 1930, which caused the death of 88 men. From January to May, 1929, there were three major disasters, which caused 70 deaths. Based exclusively on these disasters, the death rates per million tons were 0.390 for the present year and 0.280 for the corresponding months of 1929.

Comparing the accident record for the period January to May, 1930, with the same months of 1929, a reduction is noted in the fatality rate for haulage, but increased rates are shown for the other principal causes of accidents. This is particularly noticeable in the rates for gas and dust explosions and is due to the larger number of deaths in both major and local explosions in 1930.

Aims and Objects of the Research Department

By **J. S. Miller**

DIRECTOR OF RESEARCH

RESEARCH under the Lehigh Navigation Coal Company is dedicated primarily to the proposition that in these modern days anthracite coal is not simply coal, but a product to be elaborately processed and accurately adapted to the needs of a highly exacting consumer public. The existence of the Research Department is in itself evidence of the emphasis which the company places upon the quality of its product; and it is especially significant that the organization of this department in 1922 reaches back into the period when it was possible for all the anthracite companies to dispose of their production with a minimum of sales effort. To put the matter in another way, the Research Department may be described as the bridge between the complaining dealer and consumer and the operating or mining department, in whose shortcomings, if anywhere, may be said to be the source of complaints. This fact was particularly emphasized by the recent transfer of the servicing function from the commercial headquarters at Philadelphia to the mines.

But the functions of the department are not merely negative. It not only currently undertakes to run down the sources of individual dissatisfaction as they arise but it tries in a more permanent way to establish fundamental conditions which will insure the proper quality of the product, and thus eliminate consumer objections.

Probably the activity most directly related to the proper marketing and servicing of coal is that of inspection. Each of the eight collieries maintains an inspection force, which is under the direction of the Research Department. This function is entirely independent of the operating forces which have to do with the preparation of coal. The inspector is in a position not only to criticize freely the results of operation but also to make independent decisions with reference to the compliance with standards of sizing and impurities. In another article, the standards by which the department is guided are discussed in some detail. In the routing of inspection, the work of coal inspectors at the various collieries is supplemented by findings of the laboratory, which is exceedingly well equipped with the latest devices for making sizing, ash and fusion tests.

Fortified with the data supplied by this laboratory and field inspection staff, the service man, whose function is to run down specific current complaints, either at the mines or at the point of delivery, is in a position to deal with the customer on a fact basis.

Some of the activities covered lately by the department have been studies of coal preparation under which actual tests of coal prepared by various methods have been conducted. Means of preparing special coals; tests on changes made to jigs to endeavor to find best operating conditions; new devices to regulate preparation and to remove objectionable material from the market product are continually being studied.

Mining activities have covered such items as mechanical mucking; timber surveys resulting in adoption of treated timber for much gangway work; powder consumption, distribution, and control with direct aid to the user of the explosive so that the user may obtain the best results possible; records of mining in each gangway, and many other inside problems.

Mention should be made, perhaps, also of the demands of the industrial consumer as distinguished from the householder. The large percentage of fine sizes produced in the lower anthracite field emphasizes the extreme importance of marketing this part of the production. To produce, for instance, a low-ash industrial coal is not only a matter of breaker practice but of laboratory research, and a great deal of study has been put upon this problem.

Machinery is studied with idea of substitution to improve results, such as changes in roll design to increase yield, and lowering devices to decrease the speed of travel or drop of the coal to avoid breakage; improvements or installations to eliminate labor or delays; and lubrication to avoid breakdowns and decrease power.

Materials are tested to obtain those whose service cost is the least. Much of this work is conducted in conjunction with the Purchasing Department, who are continually on the lookout for better products to give an economically better service.

Of almost equal importance are the service functions of the department to the mining activities. The company is a large consumer of supplies, the cost of which, of course, is a very important element in the cost of production, and hence in the price which necessarily must be charged the consumer. To a company operating on an extremely narrow margin of profit, which under any adverse conditions becomes a margin of loss, it is of utmost importance to effect genuine economies in the uses of materials, and to install such equipment as will effect a constantly lowering cost of operation. This objective is best attained by scientific investigation.

Thus does the present state of the industry furnish a wide field of opportunity for constant and thorough research and analysis.

As an adjunct of service to the operating department in connection with the selection of equipment and materials, the laboratory conducts numerous routine tests into the strength of materials, their ability to resist the action of the elements, etc. To illustrate, one of the constant physical problems in breaker practice is to secure materials which will resist the action of the ever-present mine water, whose ravages on the breaker equipment are a cost item of major concern. This same mine water has been the occasion for extensive studies with a view to securing a longer life of rails and other steel shapes used in the mines. As a result of the studies of the Research Department, treated timber is now used on a very extensive scale throughout the inside operations where dry rot is a factor.

Studies have been made also with a view to reducing labor costs by the introduction of labor-saving devices and a proper organization of the labor forces in relation to equipment. Routine analyses of mine air are conducted as a safety measure, particularly where the proximity of a mine fire is suspected. Building materials, such as the paint used on the 900 or more company houses, is analyzed and tested for its practicability in this sort of service. This and similar investigations form the basis of standard specifications used by the purchasing agent.

Thus the functions of the department bear quite directly upon practical problems of cost and marketing. Of pure scientific research unrelated to such important interests, there has been very little undertaken. The company is hardly big enough for that. Brief reference, however, might be made to the fact that during the past year the laboratory has made some very intensive and valuable studies into the practicability of utilizing some of the by-products of mining refuse with a view to lifting some of the costs of operation from the price of coal.

To accomplish these aims, the Research Department employs the services of 12 men; 4 of whom are chemists or analysts in the laboratory, the remaining being engaged in office and field work.

SULPHUR DIOXIDE CONTENT OF PITTSBURGH AIR

The daily sulphur dioxide content of the air at the Pittsburgh Experiment Station of the Bureau of Mines has been determined by the bureau at the request of the Committee on Screen Wire Cloth of the American Society for Testing Materials. The purpose of the investigation was to obtain data for use in interpreting screen-corrosion tests, which were conducted jointly by the committee and the bureau.

A total of 304 determinations of the sulphur dioxide content of the air was made on 304 days. The average amount found was 0.16 parts per million. The maximum, 1.1 parts per million, was found on two days and less than the minimum detectable (less than 0.1 parts per million) on 141 days. On 134 days the concentration was between 0.1 and 0.4 parts per million, inclusive, and on 29 days the concentration was 0.5 to 1.1 parts per million.

A general observation was made that the concentration tended to be higher on foggy or smoky days.

Further details are given in Report of Investigations 3005, by E. G. Meiter and C. E. Traubert, copies of which may be obtained from the United States Bureau of Mines, Washington, D. C.

The Present and Future Application of MECHANIZED LOADING

By G. B. Southward

THE figures compiled by the United States Bureau of Mines for the year 1929 show that the total of 38,000,000 tons produced with mechanized loading was divided between the various classes of equipment as follows:

Mechanical loaders	16,613,000
Pit car loaders	14,786,000
Conveyers	4,906,000
Scrapers	1,549,000

These figures can be further subdivided from estimates compiled through the Mechanization Survey of the American Mining Congress according to the tonnage produced in the various seam heights. These subdivisions will not be so accurate as the tonnages given by the bureau but they will serve to show the relative status of mechanized loading in different seam thicknesses and with different classes of equipment.

An estimate of the tonnages mined with each type of loading equipment in the different seam heights is given below. In this tabulation high coal is 6 ft. or more in thickness, medium coal is less than 6 ft. and greater than 4 ft., and low coal includes seams 4 ft. or less in height.

	High Coal	Medium Coal	Low Coal
Mechanical loaders	14,361,000	2,252,000	.....
Pit car loaders	12,220,000	2,335,000	231,000
Conveyors	599,000	2,097,000	2,210,000
Scrapers	113,000	160,000	1,276,000
	27,293,000	6,844,000	3,717,000

The tonnage figures are reduced to percentages as follows:

	High Coal	Medium Coal	Low Coal
Mechanical loaders	87%	13%	0
Pit car loaders	83%	16%	1%
Conveyors	12%	43%	45%
Scrapers	9%	11%	80%

A summary of the total productions mined with all classes of loading equipment shows the following percentages in each of the various seam heights.

Mined in high coal	72%
Mined in medium coal	18%
Mined in low coal	10%

According to the census figures compiled by the United States Bureau of Mines the percentage of coal loaded mechanically in the year 1929 was 7.1 percent of the total bituminous production. It would be of further interest to know the extent to which mechanized loading was used in the various seam heights. This cannot be arrived at exactly but a reasonably close estimate can be given. A paper written by Mr. F. G. Tryon, of the United States Bureau of Mines, gives the following percentages of bituminous coal production in different seam thicknesses. These figures were made by Mr. D. C. Ashmead for the year 1920, but in all probability the percentages have not changed very materially since that time.

Seams greater than 6 ft. in thickness	30%
Seams between 4 and 6 ft.	45%
Seams less than 4 ft.	45%

Applying these percentage figures to the 1929 coal production figures would show the following.

	Total tonnage produced	Tonnage with mech. loading	Percentage of mech. loading
High coal	160,000,000	27,000,000	17
Medium coal	239,000,000	7,000,000	3
Low coal	133,000,000	4,000,000	3
Total	532,000,000	38,000,000	7.1

The above tables bring out the following facts:

(a) 7.1 percent of the bituminous coal production is mined with some form of mechanized loading.

(b) 72 percent of the mechanized tonnage is mined in high coal, mostly with mechanical loaders and pit car loaders.

(c) 30 percent of the total bituminous production is mined from seams greater than 6 ft. in thickness.

(d) 17 percent of all coal produced from seams greater than 6 ft. is mined with mechanized loading.

(e) 45 percent of the total bituminous output is mined from seams between 4 and 6 ft. in thickness.

(f) 3 percent of the output from medium height seams is produced with mechanized loading and this tonnage is divided almost equally between mechanical loaders, pit car loaders, and conveyors.

The foregoing which gives a very good idea of what has already been done can be used as a guide to what may be done in the future providing we take into account some facts which mere figures do not bring out.

To begin with it may be accepted as a basic principle that no mine is operating mechanized loading for the sake of being modern and progressive or to watch the wheels go round. The only reason which has caused mechanized loading to develop to where it is today has been the savings effected under the costs of hand loading. These savings have been made in two ways. First, as in the case of mechanical loaders and pit car loaders, by using machines to reduce or eliminate the labor in hand shoveling and increasing the production per man employed. The second, as in the case of conveyors and scrapers in thin seam mining, by reducing the labor of hand shoveling and also by concentrating the working places and confining the amount of rock brushing to a very small proportion of the mine workings.

In both of these cases the operations have succeeded in demonstrating their superiority to the old established methods of hand working, in the special conditions where the development has been made. This has led to the belief that each type of equipment is restricted to certain uses. For instance it is frequently said that conveyors and scrapers are only economical in thin seams and that mechanical loaders are only economical where a high labor rate exists. If a careful analysis is made it will be seen that this view is not correct and that each type of equipment has a much

wider application than is now generally supposed.

In each coal field where any type of equipment now predominates, certain performance standards have been developed that are considered satisfactory because of the fact that these standards bring about the needed margin of profit over the hand mining costs in that particular mine. Operators who have not yet mechanized are apt to base their belief on what can be done in their own mine on what is being done in some other district. This is the wrong viewpoint as it is a well known fact that all the types of loading equipment are producing only a small proportion of their actual potential capacity.

In thick seam mines with mechanical loaders an average maximum production is approximately 350 tons per day. This is from a machine capable of loading at the rate of over 2 tons per minute or 1,000 tons in a 8-hour shift. In the same manner, conveyor units with carrying capacities of 1 ton per minute or 500 tons in 8 hours are now producing an average of less than 100 tons per shift. The difference between the actual production and the potential capacity of these units is not in any sense due to lack of efficiency on the part of the men employed or in the direction of their work but is due to the manner or the conditions in which the machines are being used.

The present method with mechanical loading in the room and pillar system involves certain time losses that no scheduling or systematizing can eliminate. These losses are from two sources—delays in moving the operation from one room to another and the delay in the operation of the loading machine while single cars are being shifted. These delays are an inherent part of a room and pillar operation and can be eliminated by a method of long face mining where a trip of cars can be placed for loading. If the room and pillar system is continued there is no reason why some kind of a device can not be placed between the loading machine and the mine cars so that a nearly continuous loading operation could be maintained. With either of these improvements and with a reasonable degree of efficiency the present productions with mechanical loaders could be about doubled. This fact has a direct application for those fields that do not consider the present costs with mechanical loading as sufficiently attractive to warrant its adoption in their own mines.

In thin seam mining with conveyors and scrapers the tonnages now being produced with each unit installation depends on the thickness of the seam and the mining system used. With the room and pillar system it is usually customary to drive rooms about 40 ft. wide and to work the cutting and loading in a continuous cycle on the same shift. This of course means that the loading is delayed while the preparatory work is going on but even so there are mines which will make three room cleanups per shift. This amounts to over 100 ft. of face loaded out. Long face mining eliminates this delay by having all preparatory work done at night so that the entire day shift is used for loading. In mines of this kind faces 200 ft. and more in length are loaded out in a shift.

In either case the tonnage produced is in direct proportion to the height of the seam. The cost of the preparatory work of cutting, drilling and shooting is not governed by the seam height; consequently an increased height of seam would not only increase the tonnage from the unit but would also decrease the proportionate cost of the face preparatory work. When this fact is taken into account the cost of operating thick seams with conveyor mining will be much lower than the costs now had in the thin veins with the same labor rates in effect. This fact should be taken into consideration by those operators who now believe that conveyor and scraper mining is only economical in thin coal.

PRACTICAL OPERATING MEN'S DEPARTMENT

COAL

Due to the cooperation of Mr. Newell G. Alford in the preparation of the articles on the operations of the Lehigh Navigation Coal Company, which appear in this issue, the Coal Section of the Practical Operating Men's Department is omitted.

AMERICAN STANDARDS YEARBOOK LISTS STANDARDIZATION DEVELOPMENTS

Important progress in standardization work affecting mechanical, electrical, railways, mining, and other major American industries is reported in the American Standards Yearbook for 1930, just published by the American Standards Association.

George B. Cortelyou, president of the Consolidated Gas Company of New York, in a foreword to the yearbook says:

"Standardization is of prime importance at the present time to practically every American industry as a means of promoting industrial stabilization and of minimizing unemployment.

"It permits the continuous production of products and parts, during periods of slackened buying, in anticipation of future demand. For the same reason it makes for steady employment of labor. It broadens markets nationally, and even internationally.

"As a principal means of introducing improvements in design and economies in production and distribution, it furthers the sound development of industries and helps to open potential markets. On these grounds alone it merits sympathetic study on the part of every business executive."

The membership of the association now includes 43 national technical societies, trade associations, and governmental bodies. The association has, up to the present time, approved 166 national industrial standards, and projects for 171 other standards are under way.

"The new standards approved during the past year include important mechanical standards, such as tool holder shanks and tool post openings. In the electrical field, in addition to the standard for outlet boxes, there is a new standard of regulation for electric wiring and apparatus in relation to fire hazard, the code for protection against lightning, the first national standard for radio, fixing the dimensions governing fit of four-pin vacuum tube vases, and the arrangement of terminals. The railroad industry is represented by a new standard for materials for use in the manufacture of special track work. Of interest to almost all engineers is the new standard for symbols for hydraulics, aeronautics, for electrical quantities, and for telephone and telegraph use.

"The new projects initiated during 1929," says William J. Serrill, president of the ASA, "include such subjects as annular ball bearing, methods of laboratory sampling and analyses of coal and coke, standardization of Diesel fuel oils, specifications for coal mine cars and for mine timbering, locomotives for coal mines, graphical symbols used in radio communication, and general methods of testing woven textile fabrics.

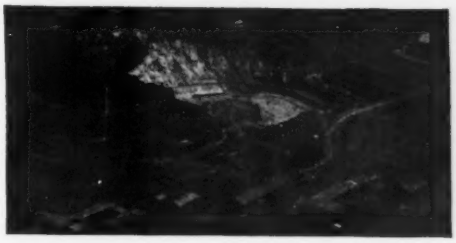
"To render the preparation of national standards in the major industrial fields more effective, correlating committees have been organized in some of these fields. There are now, for example, electrical, mining, and safety correlating committees. Efforts have been under way for some time to complete the organization of a similar committee in the mechanical field.

"There has been a very rapid growth of the ASA Information Service during 1929. Hundreds of foreign standards, new and old, have been loaned to American manufacturers and trade associations. During the year Information Service was able to take care of over 1,300 requests for information concerning standards and standardization; about 1,000 publications relating to standards and standardization, including 500 new foreign standards, were added to the association files."

METALS

GUY N. BJORGE
Editor

Practical Operating Problems of the Metal Mining Industry



Calumet & Arizona Mining Company

SULPHURIC ACID PLANT

By N. E. Jacks
ACID PLANT SUPERINTENDENT

THE Calumet & Arizona acid plant was designed to produce 200 tons of 60-degree Baumé sulphuric acid per day. It was constructed in 1916 and 1917, and began operation in March, 1917. It is a chamber plant and consists of the following parts: (1) Roasters, for production of sulphur dioxide gas; (2) dust chamber; (3) niter pots in niter flue, for introducing the oxides of nitrogen; (4) Glover tower; (5) chambers; (6) Gay Lussac towers; (7) acid circulating systems and coolers; (8) fans, for draft to move the gases.

ROASTERS, PRODUCTION OF SO_2

The ore used in the roasters is the mine run of ore from the Briggs, Junction and Denn sulphide. The average sulphur in the ore used runs from 30 to 35 percent. The sulphur in the calcines from 9 to 12 percent. The roasters used are the Herreshoff 21-ft. 6-in. diameter—6 hearths, using air-cooled arms (at present four 19-ft. 6-in. 10-hearth Herreshoff are being erected for the production of SO_2). The air for cooling the arms is discharged from the center shaft onto the sixth hearth. A tonnage of 60 to 70 tons is put through each roaster per day. These roasters operate at a high temperature, so when a higher sulphur content than 35 percent sulphur in the ore is used it is necessary to cool the roasters. The best way to do this is to reduce the feed. At the temperature at which the gas roasters operate, the ordinary cast-iron rabble soon burns up. The Fahralloy rabble gives good results. The temperature of the gases from the roasters into the downtake ranges from 1,000 to 1,150 degrees F., all depending on the percentage of sulphur in the ore, the tonnage of ore on the roaster, the draft, and the size of the particles of ore. The more uniform the size, the more uniform the results. Reaction in roasters $4\ FeS_2+11O_2=2\ Fe_2O_3+8\ SO_2$.

DUST CHAMBER

The gases pass from the roasters to the dust chamber, where the heavier particles of dust settle out.

NITER FLUE, NITER POTS

From the dust chamber the gases go to the niter flue. At this place the gases contain from 5.5 to 6.5 percent SO_2, at a temperature of 900 to 1,000 degrees F. These hot gases pass under and over the niter pots and cook the sodium nitrate, that is put into the pots through a charge door. (Niter pots are cast-iron pots set in the gas flue, into which the sodium nitrate and sulphuric acid are introduced.) The sulphuric acid used in the niter pots is introduced through a corrosiron pipe. The high silicon iron resists the action of the acid. In the decomposing of the sodium nitrate-sulphuric acid mixture, in the niter pots, sodium sulphate (called niter cake) and nitric acid vapor is found. The sodium sulphate (niter cake) is tapped from the niter pots into a trough of running water, dissolves and is carried away. The nitric acid gas passes along with the SO_2 from the roasters.

Reactions in niter flue:

$$NaNO_3+H_2SO_4=NaHSO_4+HNO_3$$
$$NaHSO_4+NaNO_3=Na_2SO_4+HNO_3$$

GLOVER TOWER

From the niter flue the gases enter the Glover tower through a flue near its bottom, at a temperature of 800 to 900 degrees F. This hot gas concentrates the acid in the Glover tower to the desired strength for shipping, 60 degrees Baumé. The hot acid leaves the tower at 280 to 320 degrees F. As the gases pass up through the Glover tower they meet a mixture of chamber acid from the chambers, and nitrous vitriol, from the Gay-Lussac, which is fed into the Glover tower through the top. It is here that the gases, moisture, and air react to form the first acid. The Glover tower has three functions to perform; first, concentrate the acid to 60 degrees Baumé or higher; second, make acid; and third, denitrate the nitrous vitriol.

Reactions in Glover Tower

$$2HNO_3+3SO_2+2H_2O=3H_2SO_4+2NO$$
$$2HSNO_4+SO_2+2H_2O=3H_2SO_4+2NO$$

The water in both reactions comes into the Glover tower as chamber acid.

CHAMBERS

The gaseous mixture now enters the chambers. It contains sulphur dioxide nitric oxide, moisture, oxygen and nitrogen. The temperature of the gases was reduced as it passed through the Glover tower. It enters the chamber at about 180 degrees F.

Reaction in Chambers

$$2SO_2+2NO+H_2O+3O=2HSNO_5$$

Moisture is added to the chambers by using water sprays, and it reacts:

$$2HS\ NO_5+H_2O=2H_2\ SO_4+N_2O_3$$

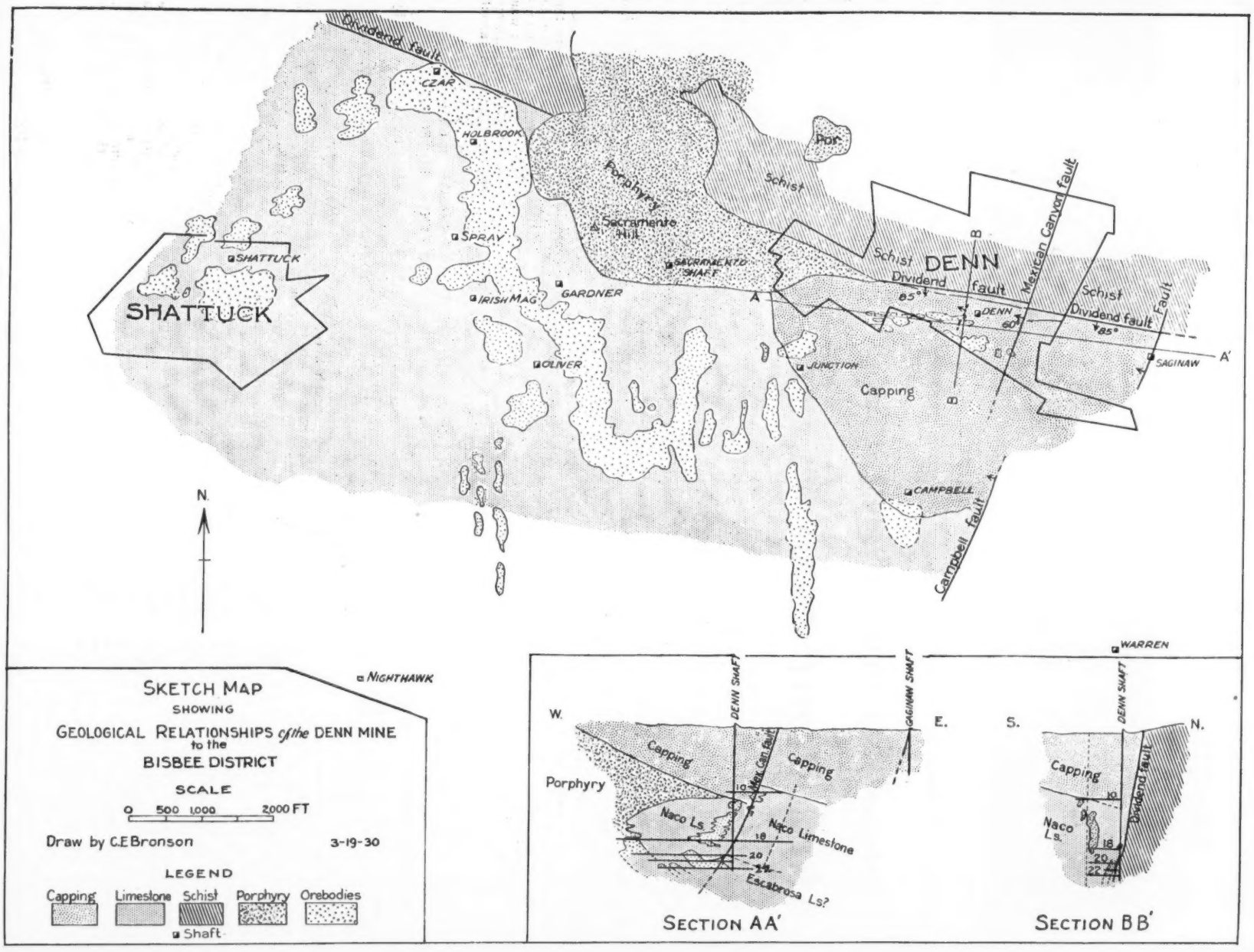
GAY-LUSSAC TOWERS

The function of the Gay-Lussac tower is to recover the niter gases. This is done by passing the exit gases from the chambers through the Gay-Lussac towers, where they meet cold 60 degrees Baumé sulphuric acid, forming nitrous vitriol. The condition of the gases through the Glover tower and chambers has to be controlled so that the exit gases will not have too much nor too little SO_2 on entering the Gay-Lussac towers. The limit is about one-tenth of 1 percent. The nitrogen oxide in the exit gases is in the form of N_2O_3 (mixture of NO and NO_2). It is absorbed by the cold 60 degrees Baumé sulphuric acid, forming nitrous vitriol.

Reaction in Gay-Lussac Towers

$$2\ H_2\ SO_4+N_2O_3=2\ HSNO_5+H_2O$$

When there is an excess of SO_2 in the exit gases, NO will be in excess, and it is not absorbed by cold sulphuric acid, but passes on to (*Continued on page* 630)


Dividend fault
CZAR
HOLBROOK
SPRAY
SHATTUCK
SHATTUCK
IRISH MAG
GARDNER
OLIVER
Porphyry
Sacramento Hill
SACRAMENTO SHAFT
Por.
Schist
Schist
DENN
Dividend fault
Mexican Canyon fault
Schist
Dividend fault
Fault
DENN
JUNCTION
Capping
SAGINAW
CAMPBELL
Campbell fault
A
A'
B
B
C
C
N.
NIGHTHAWK
SKETCH MAP
SHOWING
GEOLOGICAL RELATIONSHIPS of the DENN MINE
to the
BISBEE DISTRICT
SCALE
0 500 1000 2000 FT
Draw by C.E.Bronson
3-19-30
LEGEND
Capping
Limestone
Schist
Porphyry
Orebodies
Shaft
DENN SHAFT
SAGINAW SHAFT
W.
E.
Capping
Porphyry
Mex. Can. fault
Capping
Naco Ls.
Naco Limestone
Escabrosa Ls?
SECTION AA'
WARREN
S.
N.
DENN SHAFT
Capping
Dividend fault
Naco Ls.
SECTION BB'

History and Development of the DENN MINE

By C. E. Bronson and J. A. Wilcox

THE history and development of the Denn Mine is just another record of the faith, hope and courage of the pioneer prospector of the old West. Amongst the men connected with its location and early history were L. C. Shattuck, Maurice Denn and Joseph Muheim. That the early pioneer was not devoid of sentiment and the finer traits of human nature is shown by the fact that when Joe Muheim located the Ophir Claim he ran his line around the part of ground that had been set aside as a cemetery, although it was open for mineral location, leaving out of the Ophir Claim a fraction that has since proved to be one of the richest of the district.

The 188 acres comprising the Denn holdings are located about a mile east of Sacramento Hill. The main surface geological features are the Dividend fault and the Mexican Canyon fault, and their intersection east of the present Denn shaft. The Dividend fault is the main fault of the district, running east and west from the porphyry of Sacramento Hill, bringing the underlying schist on the north into contact with the sedimentaries on the south. The known orebearing area of the property is that portion lying south of the fault, the schist being considered barren. The most favorable ore bearing sedimentaries are the Naco and Escabrosa limestone; however, ore has been found in the other limestones. The Naco and Escabrosa limestones are found below the 1,000 level in the Denn mine and have an eastern dip of some 20 degrees. Normally these limestones would be at a prohibitive mining depth if it were not for a series of north and south breaks cutting the Dividend fault and stepfaulting the limes to a higher position east of the breaks. The Mexican fault is one of the major north and south breaks and dips to the west at roughly 60 degrees, and is estimated to have raised the limestones from 300 to 500 ft. The Campbell fault, along which the C. & A. Mining Company have found the Campbell orebody, is similar to the Mexican Canyon fault and would cut the Denn ground further to the east if it persists in its indicated strike.

A tongue of porphyry comes east from the Sacramento Hill along the Dividend fault and forms the chief rock in the west end of the property. These main geological features will give a background on which the Denn ground may be described. The accompanying sketch shows the relation of the Denn mine to the Bisbee District.

The outcroppings of these two major faults and the association of the porphyry with limes; also several siliceous outcroppings with some copper showing, was undoubtedly the principal reason for the location. One of these prospects was the old Saginaw inclined shaft operated by Lem Shattuck. The first real work was started on the Denn property on June 14, 1907, at the time of the formation of the Denn Arizona Copper Company, incorporated under the laws of Minnesota. Among the prime movers in this incorporation were L. C. Shattuck, Thomas Bardon, Sr., and Archie M. Chisholm. This organization sunk the present Denn shaft to the 1,800 level. At that time this was the deepest shaft in this end of the district and the water problem was a serious handicap. The mine was flooded several times as new water courses were cut. The faith the developers had in this property is shown by the fact that for months at a time the power bill for pumping alone ran over two thousand dollars per day. Developments from the 1,000 to the 1,800 level disclosed what is known as the sideline orebody south of the shaft and near the C. & A. property line. This orebody was continuous more or less from the 1,250 to the 1,800 level along the sideline west of the Mexican Canyon fault, and had a dip to the west about the same as the fault. It consisted mostly of oxide ores following the limestone beds. The sulphides came in on the 1,800 level.

On the 1,000, 1,100 and 1,250 levels were two rather isolated orebodies which lay east of the Mexican Canyon fault and which may be the faulted end of the sideline orebody.

The company managed to keep going until 1920, when a large water course was broken into on the 1,800 level and the mine flooded. Due to the copper slump of 1920, no further attempt was made to operate the Denn mine until May, 1925. During this intervening period the C. & A. had carried on their developments in an adjacent area and at a lower horizon. On resuming operations in 1925, a pumping agreement was entered into with the company, whereby the C. & A. handled the water from the Denn. The Denn shaft was repaired and sunk to the 2,000 level with the expectation of finding the downward extension of the sideline orebody. In 1927 the top of an entirely new orebody was found lying directly against the Dividend fault while the downward extension of the sideline orebody has not yet been determined. No 1,900 level was opened, as the Dividend and Mexican Canyon faults intersect the shaft at this point. The new discovery is known as the Dividend orebody. Its western end lies directly against the Dividend fault and diverges slightly to the southeast. Lateral developments and downward drilling show that it extends below the 2,200 level, dipping with the Dividend fault and ranking to the east about 45 degrees, butting up against the Mexican Canyon fault on the 2,100 and 2,200 levels. The ore on the 2,000 level was a capping of oxides, glance and copper bearing pyrite at various stages of oxidization. After the discovery of the Dividend orebody, drifting was continued to the west into the Ophir claim. Here the apex of some high grade ore was found and a winze sunk 50 ft. in ore, giving reasons to prospect this claim at greater depth. Work to this end was started on the 2,000 level.

This orebody, which at present is being developed on the 2,000 level, is known as the Ophir orebody and lies in vertical lenses against and near the Dividend fault, and in this respect resembles the Dividend orebody farther to the east. It differs in that it is associated with porphyry, being at the contact of the limes and porphyry which extend in and over the ore. This porphyry is probably a part of the Sacramento Hill intrusion, and its contact with the lime or other rock is often called "contact breccia," due to its admixture with the contact rock. These ore chutes are from 10 to 30 ft. wide and lie south and parallel to the Dividend fault, the low-grade pyrite and mineralized porphyry separating them.

In 1928 the shaft was sunk to the 2,200 level, and stations were cut on the 2,100 and 2,200 levels and drifting done to the west in the footwall schist lateral to the orebody. Crosscuts were driven at regular intervals to define the limits of the ore and prepare it for extraction. On the 2,100 level the orebody was found to have an average width of 60 ft., and extended as far east as the Mexican Canyon fault, making its length on this level 400 ft. The eastern end lies against the fault and appears to have been cleanly sheared off by it. On the 2,200 level the ore extends to the Mexican Canyon fault. There was also found farther to the west the apex of two orebodies which lie in the same relative position to the fault as the Dividend orebody. The apparent shearing of the orebody by the Mexican Canyon fault has brought about much discussion as to the location of the faulted end. If there has been a throw of 300 ft. on the fault as has been brought out in district geology, the faulted end of 2,100 orebody should be on the 1,800 level in an area that at this date has not been prospected. Similarly, if any ore deeper than the Dividend orebody had been cut off by the fault it would be expected to be found east of the fault and below the 1,800 level. Development work is now being carried on in this area east of the fault. This development to date has shown stringers of copper, lead and zinc. On the 2,200 level a lens of massive copper bearing pyrite was found lying against the Dividend fault. Its western end terminated at the Mexican Canyon fault and shows a displacement with the Dividend ore at the west end of the fault. Its eastern end has dipped to the east below the level. This body assays from 1 to 5 percent in copper, and is entirely different in character from the ore of the Dividend orebody west of the fault. This orebody, while of small dimensions, tends to prove the theory that the Mexican Canyon fault is post-mineral. The block of sedimentaries lying east of the shaft and east of the Mexican Canyon fault comprises four-fifths of the sedimentary or limestone area of the Denn mine. Comparatively little work has been done in this area up to this date. However, recent strikes of the C. & A. Mining Company to the north of the Campbell orebody on levels above the 2,200 both east and west of the Campbell fault, make this country in the Denn property a most interesting area, and on the results of the developments here depends the future of the Denn mine.

LEGISLATIVE REVIEW

FOLLOWING the enactment by Congress on June 14 of the revised tariff bill and its approval on June 17 by President Hoover, Congressional leaders planned immediate adjournment of the session of Congress which has been in session since December last. After disposition of the bill there was a general desire to clean the House and Senate calendars of uncontroverted measures and for committees to act on other pending bills. However, bills unacted on upon adjournment of the present session will hold their place in committee or on the calendar until the end of the present Congress on March 4 next.

For the House the present adjournment will be final until next December, but the Senate will have to remain in extra session to pass on the recent naval limitation treaty negotiated at London. During the recess, however, certain investigating committees will continue their work intermittently. One investigation, that inquiring into attempts to influence legislation, began last October, has been concluded.

While attempts to waive the annual asssessment work requirement on mining claims were abandoned in view of an unfavorable report from the Interior Department, Representative Eaton, of Colorado, presented a bill applying to oil shale claims so as to leave the matter of performing the work to the applicant for the land and a person claiming an adverse right. A law was enacted applying the provisions of section 2455 of the Revised Statutes concerning perfecting of mining rights, to coal lands in Alabama held by the Government. Another piece of legislation completed by Congress authorizes the sale by the Government of the coal and asphalt deposits on lands of the Choctaw and Chickasaw Indians in Oklahoma.

Upon recommendation of the Federal Oil Conservation Board and the Interior Department, legislation was introduced in both Houses and favorably reported by the House of Representatives authorizing cooperative or unit development of oil and gas pools. Legislation was also proposed to lease unallotted Indian lands for mining purposes.

An inquiry looking to the suppression of agreements in industries approved after trade practice conferences with the Federal Trade Commission, on the ground that they violate the anti-trust laws, has been demanded in the House by Representative Patman, of Texas. He charges specifically that a recent trade practice agreement in the oil industry contravenes these laws.

Both houses passed a bill authorizing oil and gas leases in or under railroad and other rights of way, and on lands of the Choctaw and Chickasaw Indians.

To perpetuate the conservation movement, the Senate passed a resolution setting aside the first week in April of each year to be celebrated as American Conservation Week, and a similar bill was proposed in the House.

MERGER INQUIRY

Alarmed over the concentration of business into merged groups, Representative Sproul, of Kansas, chairman of the House Committee on Mines and Mining, and a candidate for the Senate, introduced a resolution for an investigation of the economic effect of business combinations by the Federal Trade Commission. The House Interstate Commerce Committee is investigating the degree to which holding companies are operating in the railroad industry. Another inquiry is being conducted by a special House committee as to the activities of communists in this country.

Congress also authorized an investigation by a commission consisting of members of Congress and of the Cabinet as to taking private property by the Government during war. To meet the unemployment situation a proposal was made that the President call a conference to consider uniform state labor and welfare laws. Unfavorable action was taken by the Senate Judiciary Committee on a bill proposing to forbid the issuance by courts of injunctions in labor disputes.

The Muscle Shoals, Ala., nitrate and power project legislation was held up in conference to adjust the Senate bill authorizing Government operation of these works and the House bill which proposed to lease them. Congress authorized the establishment in the Bureau of Standards of a national hydraulic laboratory to consider various water problems, and was also considering making an initial appropriation of $10,000,000 for commencing construction of the Boulder Canyon power and irrigation project on the Colorado River.

MEXICAN IMMIGRATION

The Senate passed a bill applying the immigration quota restriction law to Mexico, but no action was taken by the House on the measure.

Congress completed consideration of the appropriation bills making funds available for the Government departments during the year beginning July 1, 1930. In these measures fairly liberal allowances were made for agencies dealing with the mining industry. A summary of these funds is as follows:

Treasury Department: Tax refunds, $130,000,000; field investigations by the Public Health Service, including pollution of navigable streams and lakes, $391,000; operation of mints and assay offices, $1,689,160.

Interior Department: Commission on Conservation and Administration of the Public Domain, $50,000; surveying public lands by General Land Office, $700,000, of which $50,000 is for surveys and resurveys of oil shale lands; Indian Bureau, $85,000, for allotment to the Geological Survey for inspecting mines and examining mineral deposits and supervising mining operations on Indian lands.

Geological Survey: Total appropriation, $2,789,800, which includes the following specific allotments: Topographic surveys, $819,000; geologic surveys, $300,000; fundamental research in geologic science, $100,000; investigation of mineral resources in Alaska, $75,000; gauging streams, determining water supply and preparing reports on the best methods of utilizing water resources, $510,000; examination and classification of lands for mineral and other content, $180,000; enforcing laws relating to minerals on Indian and public lands and naval petroleum reserves, $250,000. The Survey is authorized to secure aerial mapping from civilian sources or from the army and naval air services.

Operation of Alaskan Railroad, $1,000,000.

Independent Offices: Board of Railroad Mediation, $328,380; Board of Tax Appeals, $640,000; Federal Oil Conservation Board, $17,220; Federal Power Commission, $176,000; Federal Trade Commission, $1,580,000; Interstate Commerce Commission, $9,329,963; Tariff Commission, $785,000; Shipping Board, $6,346,000. The board is authorized to use the unexpended balance of funds made available by previous acts of Congress for reconditioning and operating ships for the transportation of coal to foreign ports.

Department of Justice: Enforcement of anti-trust laws, $203,600.

Department of Commerce: Bureau of Standards: total appropriation, $2,735,671, including the following specific allotments: Testing structural materials, such as stone, clays, cement, etc., $320,000; investigation of clay products, $49,000; testing railroad track, mine and other scales, $102,300; metallurgical research, $61,000; standardization of equipment, $235,000; investigation of automotive engines, $50,000.

Mine Funds

Bureau of Mines: Total appropriation, $2,549,480, including the following specific allotments: Investigation of mine accidents, $438,640; mining investigations in Alaska, $11,160; operating mine rescue cars and stations, $330,530; testing fuel, $179,210; mineral mining investigations, $165,000; oil, gas and oil shale investigations, $232,000; mining experiment stations, $230,450; operation of Pittsburgh Experiment Station, $82,200; investigating resources of helium-bearing gas and processes and methods of producing, storing, purifying and utilizing helium and helium-bearing gas, $75,000; operation of helium plants, $306,190, with authority to contract for $500,000 additional; potash investigations, $100,000; economics of mineral industries, $307,600. The bureau is authorized to continue to furnish fuel to Government departments in Washington, D. C., out of a revolving fund accumulated from payments for such fuel by these agencies. The bureau is also given funds allotted to the Army and Navy for its purchases of helium.

Department of Labor: Conciliation Service, $250,000; Bureau of Labor Statistics, $360,980; Immigration Bureau, $3,963,960, of which $1,868,440 is for coast and land border control; immigration stations, $49,000; Bureau of Naturalization, $1,156,970; Employment Service, $385,000.

War Department: $4,000,000 for fuel; $800,000 for road construction in Alaska; $260,000 for operation and maintenance of the Muscle Shoals, Ala., nitrate and power project.

The River and Harbor Bill as passed by the House provides for the acceptance by the Government from the State of New York of the Erie and Oswego Canals and their operation as barge canals at an annual cost of $2,500,000. The bill also provides for control by the War Department of the diversion of water from Lake Michigan so as to preserve a commercial waterway from the lake to the Mississippi River and to conserve existing navigation on the Great Lakes.

Residents of the Metaline mining district in Pend Oreille County, Wash., protested against suspending the law calling for the performance of annual assessment work on mining claims.

Senatorial Changes

There will be a large number of changes in the personnel of the Senate following the election in November. Already a number have been defeated for reelection in the primary and others may fall out as a result of the election. The terms of more than a third of the 96 Senators will expire on March 4 next and a number of those elected in November will immediately succeed temporary appointees of state governors to fill vacancies. Senator David Baird, Jr., who replaced Senator W. E. Edge when he was appointed Ambassador to France, will be replaced in November by the Senator to be elected, as he is not a candidate for the regular term. His most likely successor is Dwight W. Morrow, Ambassador to Mexico, who defeated former Senator J. S. Frelinghuysen and Representative F. W. Fort in the primary. Another appointee to be opposed is Senator William E. Brock, of Tennessee, for whose seat several candidates are in the field, including Representative Cordell Hull. Senator Charles S. Deneen, of Illinois, will retire March 4, having been defeated for renomination by Representative Ruth Hanna McCormick, who in turn will be opposed in the election by former Senator J. H. Lewis.

Senator Frederick H. Gillett has announced his voluntary retirement, and former Senator William M. Butler is a candidate for his seat from Massachusetts. Senator Guy D. Goff, of West Virginia has retired on account of illness, and Senator Arthur R. Gould, of Maine, declined to run again. Representative W. H. White has been nominated to succeed Senator Gould. Senator J. Thomas Heflin, of Alabama, was barred from the Democratic primary in that state because of his refusal to support the last Democrat presidential candidate, but will run as an independent for reelection. Senator William H. McMaster, of South Dakota, has been renominated, as has also Senator C. L. McNary, of Oregon. Another Senator to voluntarily retire is Lawrence C. Phipps, of Colorado, while Senator Joseph T. Robinson, of Arkansas, is having opposition for renomination. Another Senator to meet opposition is John M. Robsion, of Kentucky, former chairman of the House Mines and Mining Committee, who is serving under appointment of the governor. The veteran Senator F. M. Simmons, of North Carolina, who has served for 30 years, was defeated for renomination by Josiah W. Bailey in the primary for failure to support the Democratic national ticket two years ago. Representative L. J. Dickinson, Republican, will oppose Senator Daniel F. Steck, Democrat, for the Senate in Iowa. Former Civil Service Commissioner William C. Deming is a senatorial candidate from Wyoming to succeed Patrick J. Sullivan, serving by appointment of the governor. Senator Thomas J. Walsh, Democrat, is facing Republican opposition for reelection from Montana. Senator Thomas D. Schall has been renominated Senator from Minnesota.

Secretary of Labor James J. Davis defeated Senator J. R. Grundy for election to the Senate in the primary and, if elected, which is very probable, will take his seat at the December session, as Mr. Grundy is serving temporarily by appointment of the governor. Senator Henry J. Allen, of Kansas, serving under appointment of the governor, faces opposition for reelection from Representative W. H. Sproul, of Kansas, at present chairman of the House Committee on Mines and Mining. Senator Roscoe C. McCulloch, another governor appointee, will have opposition in the election. Representative Thomas L. Blanton, of Texas, has reentered the House, succeeding the late R. Q. Lee, who recently died and who replaced Mr. Blanton two years ago when the latter failed of election to the Senate. Senator Morris Sheppard is facing opposition for reelection from Texas. Representative J. E. Connell, of Rhode Island, has resigned to become a superior court judge in that state.

Howard I. Young New President of American Zinc, Lead & Smelting

Howard I. Young, connected with the American Zinc, Lead & Smelting Company for 22 years and vice president and manager of mining and smelting operations since 1928, has been elected president of the company, succeeding W. A. Ogg, resigned. William C. Irwin, Thornton Emmons, Charles M. Seymour, John Van Neck and Frank Bailey have been elected directors.

A special meeting of the stockholders of the company has been called for July 23 to consider changing the 200,000 shares of $25 par value to no par shares and increasing the authorized common to 1,000,000 no par shares. The stockholders also will be asked to authorize the directors from time to time to purchase preferred shares for retirement at not exceeding the par value of $25, plus accumulated dividends.

No Action Taken on Tonopah Mining Reorganization Plans

Stockholders of the Tonopah Mining Company of Nevada, at a special meeting June 23, took no action on the proposed plan of reorganization and readjustment of the capital structure of the company. President W. L. Haehnlen stated that the proposed plan would require further consideration, and as a result the meeting was adjourned until October 6. Mr. Haehnlen told stockholders that arrangements would be made for new subscription warrants to the Tonopah Corporation.

Coeur d'Alene Operators Win Decision in Suit Over Tailings Deposited in River

The United States Circuit Court of Appeals in San Francisco has affirmed a decision of the district court at Coeur d'Alene, Idaho, in dismissing a suit against the three largest mining companies in the Coeur d'Alenes for damages to agricultural lands resulting from tailings deposited in the Coeur d'Alene River. The action had been brought by Christ Lauma against the Bunker Hill & Sullivan Mining & Concentrating Company, the Federal Mining & Smelting Company, and the Hecla Mining Company, claiming $13,500 for alleged damages to his land in the valley of the Coeur d'Alene River. The land in question had been bought from one Brown, who had granted the mining companies an easement relieving them from any claim for damages as a result of tailings deposited in the river. It was on this ground that the mining companies successfully contested the Lauma claim last November in the United States District Court at Coeur d'Alene. The appeal was heard in San Francisco May 28, 1930, and the decision handed down June 16. The action of the Court of Appeals indicated favorable decisions in 14 other suits of similar nature involving an aggregate sum of several million dollars which are now pending.

C. W. Beale, of Wallace, Idaho, attorney for the Coeur d'Alene Mine Owners' Association, handled the defense for the mining companies, having represented the Coeur d'Alene producers in this capacity as far back as 1904.

Mr. Beale states that the first case of this nature was taken into court in 1904, when a group of landowners sought to secure an injunction against mine operators prohibiting the dumping of all tailings into the Coeur d'Alene River. It was brought out at that time that if such an injunction were issued, forcing all mine activities to suspend, the damage to the district would be many times more serious than the small damages alleged by the farm owners. The court held to the contention of the defense and decided against the plaintiffs.

Foreseeing possibilities of such cases, Mr. Beale secured easements from some 225 farm owners in the Coeur d'Alenes in 1910. In each case the easements released the mining companies from all liability, the same as the Brown indenture.

A. S. & R. Issuing New Stock for Expansion

The American Smelting & Refining Company is issuing $20,000,000 in preferred stock, for the purpose, officials say, of having funds available should good opportunities be seen for expanding during the present period of low metal prices. The company is reported to be considering the acquisition of the Girard Smelting Company. A project is also reported to be under consideration for doubling the capacity of the plant at Buchans in Newfoundland.

Cates Receives Medal for Distinguished Service With Utah Copper

Louis S. Cates, president of the Phelps Dodge Corporation and former vice president and general manager of the Utah Copper Company, was presented with the Jackling gold medal June 9 at a dinner held in Salt Lake City attended by more than 30 operating officials of Utah Copper. This medal is awarded each year by Col. D. C. Jackling, president of Utah Copper, to all employes who have achieved a 20-year service record.

In making the presentation, Colonel Jackling expressed the appreciation of the company for Mr. Cates' valuable services and wished him success in his new endeavors. D. D. Moffat, who succeeded Mr. Cates as vice president, presided at the dinner, which was held at the Alta Club.

Metal Freight Rate Hearings to be Resumed in Western Cities

Hearings in the non-ferrous metal freight rate investigation will be resumed by the Interstate Commerce Commission at Butte, Mont., July 21, to be followed by another hearing at Denver on July 28. They will be conducted by Commissioner Eastman and Examiners Mullen and Mattson, and will be for the purpose of getting a picture of the local situation as affecting the mines, mills and smelters. Unless there is further demand, these will be the last of the western hearings and the investigation will be taken up again probably in September with a hearing at New York, when the eastern rate situation will be considered, with particular reference to zinc. Previous western hearings were held at Phoenix and Salt Lake City. Following the New York hearing in the fall, opportunity will be given for rebuttal evidence either in Washington or New York.

Properties in Telluride District Sold

Mining interests represented by the Bowman Engineering Company, of Denver, have purchased a number of groups of mining claims in the Telluride District of Colorado, extending on an east-west line for more than 3 miles from the old Alta group in Gold King Basin, through Bear Creek Basin and Blue Lake Basin. Wagner Brothers, of Telluride, owned or controlled the properties in-

volved. The names of the purchasers and the terms of the sale were not disclosed, but it is known that the sale has been consummated following long negotiations and 10 months of exhaustive examination.

Old Dominion Leads Phelps Dodge Safety Contest

The Old Dominion Company, branch of the Phelps Dodge Corporation, has maintained its lead in the corporation's safety contest by making a perfect record for the month of May, sharing honors for the month with the Moctezuma branch, of Nacorzari. This is the fourth time in five months that the Old Dominion branch has made a clean record, having only one lost-time accident since the first of the year. The Morenci branch took second place in the May contest with only one lost-time accident, and the Copper Queen branch, with three, was in third place.

According to figures of the Labor Department of the Copper Queen branch, the rating of Old Dominion for the year to date is .009, on the basis of 1,000 shifts worked. The Moctezuma and Morenci branches, each with 10 lost-time accident since January 1, are tied for second place, with rating of .048.

In a recent issue of THE MINING CONGRESS JOURNAL it was inadvertently stated that the Moctezuma Branch was the winner of the 1928 Phelps Dodge contest. The Moctezuma Branch won the contest in 1926 and 1927. In 1928 the Morenci Branch was the winner.

Mutual Mines Company to Build Mill

Plans have been completed for the construction of a 100-ton selective flotation plant in the near future at the property of the Mutual Mines Development Company, on Canyon Creek, at Gem, Idaho, near Wallace. The plant will be equipped with a 300-ton crusher, so that additional flotation units can be added to step up the capacity from time to time as production warrants. High-grade samples of the ore body, which has been opened up for 140 ft., have assayed 40 percent lead with a proportionate amount of silver.

The Mutual property consists of 54 claims on Canyon Creek adjoining the Golconda and Square Deal on the south and the Star mine on the east.

Trout Mining Company Will Build Mill

A new silver mill is to be constructed by the Trout Mining Company on its claims near Phillipsburg, Mont., which will have an initial capacity of 200 tons a day. Approximately 100,000 tons of ore have been blocked out for immediate operation, it is reported.

PLANS DEVELOPING FOR WESTERN DIVISION MEETING IN EL PASO, OCTOBER 13 TO 15

The American Mining Congress is actively engaged in shaping the program for the annual meeting of its Western Division, to be held October 13, 14 and 15 at El Paso, Tex. Brent N. Rickard, manager of the El Paso Smelting Works of the American Smelting & Refining Company, will act as host to the convention as chairman of the Board of Governors of the Western Division, in cooperation with Robert E. Tally, of Clarkdale, Ariz., president, and J. F. Callbreath, of Washington, D. C., secretary of the American Mining Congress. Guy N. Bjorge, of Phoenix, Ariz., associate editor of THE MINING CONGRESS JOURNAL, will be in charge of the sessions of the meeting devoted to discussion of practical mine-operating questions.

Mining and milling methods and smelter operations will be the basis of a number of addresses by mine-operating officials from various sections of the West and Southwest. Part of the discussion is expected to center around the factors which determine whether future mining operations at a property should be pursued by steam-shovel or underground methods in copper and other metal-mining operations. Addresses will be made by members of the operating staffs of numerous mining companies as to operations at their mines. Papers will also be presented on the geology of ore deposits and recent developments in ore crushing.

In addition to the active participation of the Arizona Chapter of the Mining Congress, several other organizations will take part in the meeting, including the American Association of Engineers, the West Texas Geological Society, the Association of Oil Geologists, American Institute of Mining and Metallurgical Engineers and the Centro Nacional de Ingenieros.

A large number of mining men from Mexico are planning to attend the convention and contribute to the program by a discussion of the position of mining properties under the laws of that country.

Entertainment features which are being arranged for the delegates include inspection trips to metal and oil refineries, power plants and cement works at El Paso and in the vicinity.

Congress to Consider Mine Taxation Revision in December

The possibility of revising present methods of mine taxation, with special reference to the depletion provision, has received considerable attention in Congress recently, with the result that Representative Hawley, of Oregon, chairman of the Joint Congressional Committee on Internal Revenue Taxation, has announced that hearings will be held next December on mine depletion.

"The joint committee some time ago instructed its staff to make a study of the question of depletion in mines," said Mr. Hawley. "The industry desired a hearing on the subject, and such hearing was agreed to be given at some date to be later fixed in December. It also requested the Treasury Department to furnish the committee whatever information it may have on the subject. Depletion in mining is the equivalent of depreciation in buildings and machinery."

Senator Oddie, of Nevada, told the Senate recently that present depressed conditions in the metal mining industry are in part due to taxation through the operation of the present depletion law, and suggested an investigation.

"State and local taxes have increased materially of recent years and the mining industry as a class has borne a substantial, if not unjust, share of the burden," Mr. Oddie said. "The Federal income tax constitutes one of the largest of overhead expenses, one that becomes of increasing moment when production and earnings are declining materially. The situation appears to be further aggravated by conditions which have arisen in connection with the depletion deduction.

"Through the manner in which depletion is calculated gross inequalities and discriminations are unavoidable. Many smaller taxpayers are placed at a disadvantage, in that they do not have the means and facilities necessary successfully to prosecute their cases before the Treasury Department. Delay and uncertainty in the final determination of tax liability is common. Through the effect of the depletion deduction taxpayers in all other respects similarly circumstanced, taxpayers enjoying the same earnings, are not paying anything like the same taxes. There are instances in which neighboring properties are taxed at materially different rates, the rate in one case being sometimes 100 percent in excess of that assessed in the other, despite the fact that both properties are operating under identical conditions, producing the same metal, selling their prod-

uct in the same market, and enjoying, as nearly as may be, the same profit per unit of metal produced.

"This inequitable and indefensible situation results from what is known as the depletion deduction. It is apparent that something is wrong. The system under which such results are possible calls for prompt investigation."

That present modes of taxation of the mining industry must be changed, if not altogether scrapped, in the interest of right and justice to the mining industry, is the opinion of Senator Dill, of Washington.

"Under the existing methods of taxation the income tax paid by one engaged in mining is principally dependent upon the amount of depletion allowed by the Treasury Department," Mr. Dill pointed out. "This deduction, in turn, is based upon factors which are largely the result of personal opinion or individual judgment of the employes of the income-tax bureau.

"This practice has brought about a discriminatory and indefensible condition. This unsatisfactory system was abandoned in the oil and gas industry some years ago. So far as I know, there never has been any complaint about the abandonment of the old method of depletion. Similar consideration was asked for the mining industry when the Ways and Means Committee was engaged on the 1928 revenue measure. Nothing was done about it.

"I understand that a joint committee is studying the improvement of methods of collecting internal revenue. I want respectfully to urge that committee to give consideration to some other method of determining the income-tax burdens of the mining industry; and I want to suggest, in that connection, what is known as the percentage depletion. It is being practiced across the line in Canada, and has worked quite satisfactorily. It may be that the committee will not want to follow that method; but certainly the present method of taxation is inequitable and burdensome and discriminatory, and demands attention, which I hope will be given by the members of the joint committee when they take up the subject."

New Power Commission to be Appointed

The President has approved an act of Congress authorizing a new Federal Power Commission of five members, and will shortly appoint the body, which will replace the present commission of three members who are members of the Cabinet. To carry out the new law an appropriation of $176,000, in addition to $111,920 previously appropriated, has been requested for its expenses for the year beginning July 1, 1930.

Phelps Dodge Contracts for Gas

The Phelps Dodge Corporation has signed a contract with the Western Gas Company for a supply of natural gas for operation of its smelter at Douglas, Ariz., and mines at Bisbee, Clifton and Morenci, according to an announcement made by Louis S. Cates, president. The gas company will extend pipe lines from the gas fields in Lea County, N. Mex., to Douglas, a distance of 210 miles.

Calumet & Arizona also is reported to have contracted with the Western Gas Company for fuel to be used at Douglas and Morenci.

Dayrock Mining Company Acquires Coeur d'Alene Properties

Frank M. Rothrock, acting for the Day Rock Mining Company, has acquired a large group of workings in the Coeur d'Alenes, consisting of three-sixteenths of the California lode, all of the Black Cloud, Sunshine and Iowa lodes, Sunshine and Black Cloud millsites, the old Black Cloud mill and water rights, including flumes and pipe lines. Deed for the transaction shows that the properties were acquired from Franklin Pfirman, trustee of the California Consolidated Mining Company, the purchase price being around $40,000. No plans have been announced, but it is assumed that the old workings will be reopened in the near future to permit an underground examination.

Congress Directs Attention to Silver and Measures to Alleviate Situation

Steps looking to the calling of an international conference to stabilize the price of silver are proposed in a resolution introduced by Senator King, of Utah, prompted by the continued decline and low level in the price of the metal.

The resolution points out that the Government has in the Treasury silver bullion valued at more than six and one-half million dollars; 494,000,000 coined silver dollars, against which silver certificates have been issued, and silver coins, consisting of half and quarter dollars and dimes, of the face value of more than $5,000,000, and has in circulation more than 38½ million silver dollars, and silver half dollars, quarter dollars and dimes of the face value of more than $281,000,000, all of which were purchased at prices much higher than those now prevailing for silver bullion, and any further decline, measured by gold, in the price of silver, will result in additional losses to the Government.

"A considerable part of the foreign trade of the United States is with countries in which silver is extensively used as a medium of exchange," the resolution states, "and if the price of silver is further depressed the purchasing power of many countries will be materially reduced to their injury as well as to the injury of the United States.

"China and India, which represent more than one-half of the world's population, have been the principal consumers of silver, and any policy that will further depress the price of silver or prevent its advancement to normal levels will injuriously affect the economic and industrial condition of the United States, as well as of other countries.

"It will be advantageous for the United States to expand its foreign trade and commerce, and particularly to find markets for its surplus products in the Orient, and in all silver-producing countries, such as Canada, Mexico, Bolivia, and Peru.

"Efforts are being made to induce China to demonitize silver and adopt a fiscal policy calling for a new currency based upon a gold standard fund, and to further debase silver and curtail its use in India, which said efforts, if successful, will result in a further destructive decline in the price of silver, and in economic and industrial injury not alone to silver-producing countries but to all countries of the world.

"It is important," the resolution continues, "not only to countries producing silver, but to all countries engaged in trade and commerce, that measures be adopted to avert the disastrous consequences that will inevitably follow a further decline in the price of silver, and to secure an international agreement, or the adoption of an international policy that will stabilize the price of silver and obtain for it a suitable status in the monetary systems of the world.

"It is believed by many persons that an international conference should be called for the purpose of considering and taking action upon the questions herein referred to."

The resolution directs the President to confer with such governments as he may deem proper and through such agencies as he may see fit, for the purpose of ascertaining whether economic and other conditions are propitious for the convening of an international conference to consider and devise plans to increase the use of silver for monetary and other purposes, and to bring about the stabilization of the price of silver.

Research Work Proposed

To relieve the situation and to check the present price decline of silver and stabilize its value, Senator Oddie has requested Secretary of Commerce Lamont to allot appropriations of $100,000 for research work for three of the branches of the department. Of this fund $50,000 would go to the Bureau of Standards and $25,000 each to the Bureau of Mines and

Bureau of Foreign and Domestic Commerce.

The fund for the Bureau of Standards is designed to expand the consumption of silver in the arts, following a former inquiry by the bureau as to tarnish resisting silver alloys, as to which the Senator says:

"The situation warrants continued effort along similar lines, as nothing would expand the consumption of silver in the arts more certainly and more greatly than the development of a silver alloy which would resist tarnish. There are also other possibilities for increasing the use of silver in industrial ways which should be made the subjects of research. If funds should be allocated to the bureau, the investment would be more than justified and the silver situation greatly relieved. Progress in research frequently is low, and no time should be lost in initiating a comprehensive research campaign in the bureau."

As to the Bureau of Mines inquiry, Senator Oddie says:

"It would be helpful if the bureau could be allocated funds for investigating the economic relationship between silver, copper, lead and zinc, with a view to determining more precisely the declines in the production of copper, lead and zinc and the far-reaching economic ramifications of silver in the general economy of the United States."

Senator Oddie suggests that the Finance and Investment Division of the Bureau of Foreign Commerce conduct inquiries concerning silver and economic conditions in China and India. "The extremely low price of silver is a most important factor in the present disturbed economic conditions throughout the world, and it not only seems justified but highly necessary that the Government should conduct investigations along the lines indicated with a view of determining the best possible solution of the problem," the Senator says. "The price of silver has declined to 34 cents per ounce, the lowest in history, and the condition of the silver mining industry is so critical that it is a matter of public concern. The prices for the base metals, copper, lead and zinc, which are produced with silver, are low at the present time, and this accentuates to a marked degree the adverse effect of the low price of silver on the production of the base metals."

PRODUCTION OF GOLD AND SILVER IN THE UNITED STATES IN 1929

[Arrivals at United States Mints and Assay Offices and at private refineries compiled by the Bureau of the Mint, with the cooperation of the Bureau of Mines.]

States	Gold		Silver	
	Ounces	Value	Ounces	Value *
Alaska	374,669	$7,745,100	478,973	$255,293
Alabama	10	200	.....	.....
Arizona	211,108	4,364,000	7,840,321	4,178,891
California	409,020	8,455,200	1,194,651	636,749
Colorado	220,285	4,553,700	4,415,838	2,353,642
Georgia	58	1,200	13	7
Idaho	19,597	405,100	9,533,327	5,081,263
Illinois	.....	.....	4,146	2,210
Michigan	.....	.....	17,899	9,540
Missouri	.....	.....	146,638	78,158
Montana	55,854	1,154,600	12,613,580	6,723,038
Nevada	158,941	3,285,600	4,746,750	2,530,018
New Mexico	33,026	682,700	1,060,494	565,243
North Carolina	174	3,600	14,414	7,683
Oregon	17,657	365,000	37,840	20,169
Pennsylvania	745	15,400	5,616	2,993
South Dakota	312,328	6,456,400	84,465	45,020
Tennessee	653	13,500	96,146	51,246
Texas	1,263	26,100	1,042,273	555,531
Utah	237,221	4,903,800	17,844,657	9,511,202
Vermont	.....	.....	3,633	1,936
Washington	3,972	82,100	51,639	27,524
Wyoming	48	1,000	8	4
Philippine Islands	151,757	3,137,100	94,547	50,394
Totals	2,208,386	45,651,400	61,327,868	32,687,754

* Value at 53.3 cents per ounce, the average New York price of bar silver.

Comparison with 1928 production indicates reduction in 1929 of $514,000 in gold and increase in 1929 of 2,865,361 ounces of silver. Comparison with the year of largest production, 1915, when gold amounted to $101,035,700 and silver 74,961,075 ounces, gives reductions, respectively, of $55,384,300 gold and 13,633,207 ounces silver.

Idaho Bureau of Mines Plans Surveys

The most ambitious program of geological field work in the history of the Idaho Bureau of Mines and Geology is planned for this summer, according to an announcement of Dean A. W. Fahrenwald, of the University of Idaho School of Mines, secretary of the bureau.

Included in the program is the completion of Dr. F. B. Laney's geological studies of the Seven Devils District in Adams County, which have extended over a period of several years; surveys in the Stokes and Dolomite mining districts, Cassia County; the Thunder Mountain region; the Little Wood River District, Blaine County; and continuance of studies of the Bayhorse quadrangle in the Boise Basin country.

Public Lands Committee Meets

The Committee on the Conservation and Administration of the Public Domain, appointed by President Hoover to make a study of and report on public-land problems, met at the Interior Building, Washington, D. C., early in June. The meetings of the committee were held for the purpose of obtaining reports from the various Government offices having to do with the administration and disposition of the public domain. Reports were received in writing from various departments and bureaus and conferences were held with the heads of the General Land Office, Bureau of Reclamation, Geological Survey, National Park Service, Indian Office, chairman of the Interior Department Oil Committee, and the Forest Service. Reports were presented by the representatives of the public-land states, covering the conditions of the state lands, their disposition, administration and use. Reports were received from all the states regarding the use made by those states of the public domain within their boundaries.

The committee has suspended hearings in order to give the members an opportunity thoroughly and carefully to study the mass of material presented. No conclusions have been reached nor can be reached at this time. The points developed show clearly how diverse and intricate are the many problems interwoven with the details of the administration, use, and disposition that have been made and might be made of the public domain.

The committee is studying conservation as applied to resources such as water, timber, grazing, coal, oil, gas, phosphates, potash and other minerals, in relation to the public domain. The committee has found that no problem of use of one resource can be considered alone, but that each is quite likely to be and generally is complicated by the use of the public domain for various other purposes.

The report from the General Land Office shows much administrative detail in the survey of the public domain and its disposition in accordance with many acts of Congress, covering a period of more than 75 years. Disposition of the unreserved and unappropriated public domain can only be made subject to the various interests and rights that have vested in those who have initiated those rights under the laws of the United States. The committee is also considering the effect of railway grants made to transcontinental systems, and various rights-of-way granted from time to time or authorized by Congress.

During the summer months there will

be informal conferences between the individual members of the committee as opportunity occurs, in order to enable them to become familiar with the various problems and the inter-relation of the uses of the Federal and state lands.

It is apparent from the material now before the committe that the problem of the conservation of the resources of the country is one of great intricacy and will require careful study before a useful conclusion can be reached. The committee appreciates that conservation does not mean the indefinite locking-away of resources, but does mean their wise use in accordance with the current as well as future needs of our people. The problem also involves careful study of the relations between the nation and the states, to the end that the resources within each state may be developed to produce the greatest possible benefits to the state in harmony with the needs of the nation and the requirements of the public welfare.

The following members were present:

Dr. Ray Lyman Wilbur, Secretary of the Interior, ex-officio member; Arthur M. Hyde, Secretary of Agriculture, ex-officio member; James R. Garfield, chairman, of Cleveland; I. M. Brandjord, Helena, Mont.; James P. Goodrich, Winchester, Ind.; Perry W. Jenkins, Big Piney, Wyo.; Rudolph Kuchler, Phoenix, Ariz.; George W. Malone, Carson City, Nev.; George Horace Lorimer, Philadelphia, Pa.; Dr. Elwood Mead (representing California), Washington, D. C.; I. H. Nash, Boise, Idaho; William Peterson, Logan, Utah; Mrs. Mary Roberts Rinehart, Washington, D. C.; Huntley N. Spaulding, Rochester, N. H.; R. K. Tiffany, Olympia, Wash.; Wallace Townsend, Little Rock, Ark.; E. C. Van Petten, Ontario, Oreg.; Francis C. Wilson, Santa Fe, N. Mex.

Bethlehem Holds First-Aid Field Day

Bethlehem Steel Corporation held its sixteenth annual interplant first-aid competition on June 22 at Bethlehem, Pa., and the team representing the Preston Division, of Fairmont, W. Va., captured first honors in the first-aid competition among the mine squads with a percentage of 99.85. The Johnstown Division placed second, and the team of the Heilwood Division won third place. In mine rescue the Johnstown Division took the honors.

The Steelton plant of the corporation took first place in the interplant first-aid contests with a score of 98 percent.

Presentation of awards and trophies were made by Eugene Grace, president of the corporation.

The program included contests among girl teams and Boy Scout teams from the various divisions.

Illinois Mining Institute Holds Successful Summer Meeting

The summer meeting of the Illinois Mining Institute was held on board the steamer *Cape Girardeau* and was voted to be the most successful gathering held by the Institute. There were over 100 members present, in addition to representatives from several states outside of Illinois. The steamer left St. Louis on Friday night, June 6, and went up the Illinois River, returning to St. Louis Sunday noon.

The following very interesting program was held on Saturday:

9 a. m.—Address of welcome by Prof. A. C. Callen, president.

Chairman, F. F. JORGENSON, division manager, Consolidation Coal Company, Fairmont, W. Va.

Mine Accidents in Illinois Mines, by JOHN G. MILLHOUSE, director, Department of Mines and Minerals, State of Illinois.

Safety—Real or Synthetic, by DAN HARRINGTON, chief engineer, Safety Division, U. S. Bureau of Mines, Washington, D. C.

1.30 p. m.—*Chairman*, JOS. D. ZOOK, president of Illinois Coal Operators' Labor Association.

Mine Cost Acounting, by T. T. BREWSTER, president, Mt. Olive and Staunton Coal Co.

Treated Timbers for Mines, by A. R. JOYCE, vice president, Joyce-Watkins Co.

3.30 p. m.—*Chairman*, W. J. JENKINS, president, Consolidated Coal Company of St. Louis.

Track-Cutting Machines, by W. C. ARGUST, division superintendent, Peabody Coal Co., Taylorville, Ill.

Development of Mechanical Loading, by G. B. SOUTHWARD, mechanization engineer, American Mining Congress, Washington, D. C.

9 p. m.—Moving picture.

The morning session was devoted to papers and discussions on safety, particularly in its relation to the development of mechanized loading. The paper by Mr. Millhouse gave figures on the accident rate in the mines of Illinois for more than 40 years, and showed that with the constantly increasing use of underground machinery there had been a corresponding decrease in the number of fatal accidents for each ton of coal mined. Mr. Harrington, in his paper, pointed out that care must be exercised in the use of electricity underground, and that proper safeguards were necessary to insure a greater measure of safety than was now being had.

In the afternoon session, presided over by Mr. J. D. Zook, the paper Mine Cost Accounting, prepared by Mr. T. T. Brewster, outlined some general principles for mine cost accounting. The subject of "Treating Mine Timbers," by Mr. A. R. Joyce, was illustrated with charts, showing the increased life of treated timbers that had been recorded by several of the principal railroads in Illinois. He also suggested that marked economies could be had by the coal mines in treating their ties and underground timbering. The discussion of this paper developed the fact that several coal companies in Illinois now had wood preserving plants of their own in operation.

The third session was presided over by Mr. W. J. Jenkins, president of the Consolidated Coal Company of St. Louis. The paper by Mr. W. C. Argust, division superintendent of the Peabody Coal Co., described their operations with track-cutting machines. This was discussed at length, and some very interesting tonnage records by operating companies were presented. The paper on the Development of Mechanical Loading, by Mr. G. B. Southward, described the increases which had been made in the loading machine tonnages during the past few years. His paper emphasized the necessity of coordinating the other mining operations to the requirements of mechanized loading and pointed out that a better coordination would undoubtedly be had in the future which would tend to increase the productions now being made.

Saturday night a moving picture of the Wildwood operation of the Butler Consolidated Coal Company was shown.

Rocky Mountain Coal Mining Institute Meets at Denver

The first session of the Rocky Mountain Coal Mining Institute, held in Denver the latter part of May, covered the business and selling end of the industry, and was featured by two unusually interesting papers.

The safety session was handled by V. O. Murray, safety engineer of the Union Pacific Coal Company, Rock Springs, Wyo., who spoke on the general subject of safety; by Simon Ash, engineer of the United States Bureau of Mines, discussing falls of roof; and by S. S. Temple, superintendent, Colorado Fuel & Iron Company, on systematic timbering, its object and its enforcement. This aroused a great deal of active discussion led by James Dalrymple, chief coal mining inspector of Colorado; D. K. Wilson, deputy mine inspector of Wyoming; James Burnes, safety inspector, Routt County Coal Operators' Association; and E. H. Denny, United States Bureau of Mines, Denver. As usual, discussions bearing on safety provoked the greatest interest.

Unfortunately, the paper on Shooting, by Hirum Petersen, was not presented, so that the powder men had no interest, but the two other papers on Cardox and on the Victor-American

Wedge Cylinder, brought out a great deal of discussion and offered something novel to the operators present.

Preparation of coal for domestic market was handled in a most exhaustive paper, by J. B. Morrow, preparation manager for the Pittsburgh Coal Company, read by J. R. Campbell, of Pittsburgh. The paper was followed by a general discussion.

The Joseph A. Holmes certificate was presented by Mr. E. H. Denny to the Shamrock Coal Company, in recognition of their exceptional record in safety.

On the subject of mechanical loading some very novel and useful conveyor data was presented by the Victor-American Fuel Company, and some excellent views were shown of high coal loading work at the Kenilworth mine of the Independent Coal & Coke Company of Utah.

R. E. Miller, assistant general superintendent of the Sheridan Wyoming Coal Company, gave a very clear talk on the system of haulage for serving Goodman power shovels and Joy loaders, in a flat vein of high coal at Kleenburn, Wyo., the result of several years of experiment and study.

A novelty of the meeting was the presentation of three unusual films, a talking picture by the General Electric Company, explaining the making of sound film, with a most interesting talkie of the practical application of the atomic hydrogen flame; the story of dynamite, a silent movie by the Dupont people; and Wildwood, a 100 percent mechanized mine, offered by Westinghouse E. & M. Company.

Vocational training was presented by F. M. Treat, of the Wyoming State Board of Education, supplemented by C. G. Sargent, of the Colorado State Board, and D. W. Rockey, of the New Mexico State Board, and aided by Mr. H. A. Tiemann. This was a very carefully worked symposium, the last paper on the program, and the discussion lasted until the chairman was forced to adjourn the meeting. The tenor of the discussion was toward the safety end of vocational education rather than the efficiency end.

The interest grew as the meeting went on, and the volume of discussion after the papers was greater the last day than all the other days, which showed that it was enjoyable. We were favored by fine weather, and in spite of the low condition of the coal industry in the West the attendance was up to normal, there being 140 registered for the meeting, together with their wives.

Among the resolutions adopted was one to the Director of the Budget of the United States, recommending the authorization of necessary funds for the continuance of the useful and beneficial work of the United States Bureau of Mines.

The new officers are: G. A. Kaseman, Albuquerque, N. Mex., president; Frank R. Wood, Trinidad, Colo., vice president for Colorado; R. E. Miller, Kleenburn, Wyo., vice president for Wyoming; G. A. Schultz, Latuda, Utah, vice president for Utah; Sharp Hanson, Gallup, N. Mex., vice president for New Mexico; Benedict Shubart, Denver, Colo., secretary and treasurer.

The executive board consists of the following:

Colorado: G. A. Fruth, Denver; Robert Medill, Oak Hills.

Wyoming: J. E. Edgeworth, Rock Springs; G. A. Brown, Superior.

Utah: David Brown, Spring Canyon; W. N. Wetzel, Mohrland.

New Mexico: G. C. Davis, Dawson; H. F. Mills, Gallup.

Boone Coal Properties in West Virginia Sold at Auction

Coal lands and other properties in Fayette County, W. Va., owned by J. D. Boone and the J. D. Boone Coal Company, of Fayetteville, and D. W. Boone, of Lookout, W. Va., brought a total of $161,925 when sold early in June by special commissioners of the Fayette County Circuit Court.

Included in the properties sold are the following: Two thousand two hundred and six acres of coal lands at Kanawha Falls, owned by J. D. Boone, to C. W. Osenton, Fayetteville, for $59,025; one-fourth interest, held by D. W. Boone in several tracts of land at Lookout, to the Winona National Bank for $43,500; the J. D. Boone Coal Company mine equipment at Kanawha Falls to the Barnes and White Electric Company for $4,000, and the J. D. Boone Coal Company coal land leaseholds to C. W. Osenton, Fayetteville, for $25; the J. D. Boone residence at Fayetteville, to L. E. Huffman, Charleston, for $8,600.

The sale, ordered to satisfy claims of creditors, was held after the Federal court had refused to halt it by injunction. Voluntary petitions in bankruptcy were filed in court earier in the month by James D. Boone and D. W. Boone. James D. Boone listed liabilities of $621,177.24 and assets of $407,091.91, while D. W. Boone listed liabilities of $556,341.40 and assets of $192,840.75.

An involuntary petition in bankruptcy is pending in the court against the New River Export Smokeless Coal Company, of which D. W. Boone is president. Creditors were to appear before the court referee at Charleston on June 19 to select a trustee and file proof of their claims of the company, which holds 4,600 acres of coal lands and operates two mines at Lookout and one in Michigan, both in Fayette County, W. Va.

Progress Being Made in Solving Stream Pollution Problem in Pennsylvania

The War Department submitted a report to Congress recommending that as the problem is receiving suitable attention from the Sanitary Water Board of Pennsylvania, no further action be taken concerning pollution of the west branch of the Susquehanna River. The report states that the river is badly polluted from its source to Lock Haven by drainage from bituminous mines and wastes from manufacturing plants.

"There is a desire to have the stream restored for recreational use without destruction of the mining and manufacturing industries on which the prosperity and welfare of the communities depend," says the report. "This pollution does not affect the navigable capacity of the stream. The Sanitary Water Board, which has authority to require the application of suitable corrective measures is conducting investigations with a view to determining the best method of treating the polluting substances prior to their discharge into the stream and of eliminating the causes of pollution. Reasonable progress is being made and effective results are to be expected."

Powdered Coal Fuel in Nova Scotia Power Plant

The Dominion Steel Company has recently completed construction of a power plant near Glace Bay, Nova Scotia, where pulverized coal supplied from the company's mines in the district will be used as fuel. The new plant will generate 55,000,000 kw. h. annually—the largest electric development in eastern Nova Scotia. High-tension power lines to carry the current to neighboring industries and towns have also been completed. The project is estimated to have cost about $1,000,000.

Coal and Heating Industries Studying Fuel Burning

A committee representing the coal and heating industries has been organized at Chicago to promote heating satisfaction with solid fuels. It is made up of representatives of the following organizations: National Coal Assn., Anthracite Institute, American Wholesale Coal Assn., National Retail Coal Merchants' Assn., National Warm Air Heating Assn., Heating and Piping Contractors' National Assn., Institute of Boiler and Radiator Manufacturers, National Sheet Metal Contractors' Assn., Midwest Stoker Assn., and the fuel accessories industries. The officers are H. A. Glover, Consolidation Coal Co., New York, chairman; E. B. Langenberg, of St. Louis, vice chairman; George Harms, of Peoria, Ill., treasurer; and Lorin W. Smith, Jr., of Minneapolis, secretary.

Winifrede Coal Company Lands Sold

Twelve thousand acres of coal lands in Kanawha and Boone Counties, W. Va., belonging to the Winifrede Coal Company, were sold the latter part of May to Ralph Beaton, of Columbus, Ohio, for $148,000. The sale was made by V. L. Black, special commissioner in the suit of John A. McCarthy and others against the coal company and others. Sixty thousand dollars was paid in cash and notes were given for the remainder of the purchase price.

Union Pacific Closes Cumberland Mines

After 30 years of steady operation, the Cumberland Mines of the Union Pacific Coal Company, located in southwestern Wyoming, were closed June 21 on account of the exhaustion of the coal resources. Practically the entire output of these mines was shipped to the Oregon Short Line Railroad and the C. W. R. R. & N.

For several years The Union Pacific Coal Company has spent large sums of money in an effort to develop new production, but, while small areas have been mapped, coal in sufficient quantities to open a new mine has not been located, with the result that it has been found necessary to abandon the property.

The employes will be transferred to other mines of the coal company in the Rock Springs field.

Before leaving for their new homes, the people of Cumberland arranged a large celebration, and large delegations came from all of the southwestern Wyoming mining districts.

Huge Blast Moves Overburden from Locust Summit Workings

A charge of 40 tons of dynamite was exploded June 20 to open a large section of the Locust Summit strippings of the Philadelphia & Reading Coal & Iron Company. Approximately a thousand holes were sunk preparatory to the blast.

J. D. Sisler Named West Virginia State Geologist

James D. Sisler, formerly associate geologist in charge of coal, oil and gas for the State of Pennsylvania, has been selected by the State Geological and Economic Survey Commission to be state geologist of West Virginia. Mr. Sisler succeeds the late C. M. Lemley.

The new head of the West Virginia Survey is a native of Morgantown, W.

UNION PACIFIC CELEBRATES ANNUAL FIELD DAY

The Union Pacific Coal Company was host to a happy gathering of coal miners and their wives and children on June 13 and 14 when the company staged its annual first-aid field day and Old Timers' Association meeting at Rock Springs, Wyo.

Ten teams from the company's mines at Rock Springs, Reliance, Winton, Superior, Hanna and Cumberland, Wyo., and Tono, Wash., participated in the first-aid contests. The Tono team triumphed over its Wyoming rivals, getting a score of 1,992 points out of a possible 2,000. Rock Springs No. 8 team was only five points behind the winner with 1,987 points, and the team from Superior placed third.

Sixteen teams of Boy and Girl Scouts were entered in other divisions of the meeting.

The meet was the most successful ever put on and was largely attended, being held in the Union Pacific Coal Company Old Timers' Building at Rock Springs. W. D. Ryan, of the U. S. Bureau of Mines, with E. H. Denny, Roger Manning, Robert Dalrymple, R. N. Coates, Lyman Fearn, David K. Wilson, M. K. Quealy, Louis M. Kuhns, Matt Strannigan and Frank Pelican acted as judges.

In the evening a banquet was held for the Boy and Girl Scouts at which the Tono first-aid team and all the judges took part, in addition to officials of the company. President McAuliffe and Mrs. McAuliffe presented the awards to the winners in the first-aid contests.

On June 14 one of the most successful Old Timers' meetings ever was held at Rock Springs, starting in the morning with the business meeting and winding up in the evening with the annual banquet. Chris Johnson was elected president of the Old Timers' Association. The day included a program of music by the Cumberland, Hanna, Rock Springs and Reliance-Winton bands and President McAuliffe's "Kiltie Band," a parade of the "Old Timers," and a banquet in the evening. At the banquet 750 members of the Association and their families were present and enjoyed a splendid program. This was followed by entertainment, a feature of which was the exhibition of dancing and singing put on by several groups of foreign employes in their native costumes.

The Tono Team, Winner of the First Aid Contest.

Below, some of the members of the Union Pacific Coal Company's Old Timers Association at the annual reunion at Rock Springs, June 14.

Va., and a graduate of West Virginia University. He served with the West Virginia Survey during the summer of 1919, following his graduation from West Virginia University, and then accepted a scholarship at Johns Hopkins University for graduate study in geology, during which time he served as assistant state geologist of Maryland.

In 1921 he was appointed to the Pennsylvania Topographical and Geological Survey as associate geologist in charge of coal, gas and oil.

S. B. Thorne Dies

S. B. Thorne, head of Thorne, Neale & Company, and other coal and allied corporations, died suddenly June 3 in New York City. Mr. Thorne was 57 years old. He became identified with the coal industry following a scholastic career at Yale and Lafayette College. His first connections were with the Pennsylvania Coal Company, of which he became a controller in 1901. Among the early enterprises in which he engaged was the Buck Run Coal Company, of Minersville, Pa., a prominent anthracite producer. The sales organization, Thorne, Neale & Company, was formed about 20 years ago.

New Canadian Tariff Act

The Canadian Parliament has passed an act granting a bounty of 49½ cents per ton on bituminous coal mined in Canada and used in the iron and steel industry in that country. The new tariff act includes a new item on feldspar, and provides for a drawback of 99 percent of the duty on steel billets when used in the manufacture of seamless pipe, tubes and flues, intended for the manufacture and repair of pressure parts of boilers, pulp-mill digesters and vessels for the refining of oil, and when used in the manufacture of well-drilling machinery and apparatus. Amended items include zinc strips, bars imported by manufacturers of chains, sheets for the manufacture of hollow-ware coated with vitreous enamel; roller chain, copper and zinc sheets, ball bearings and gasoline engines and electric motors for use in the manufacture of washing machines. The sales tax is reduced from 2 to 1 percent.

Increasing Number of Fuel Dealers Handling Both Coal and Oil

In a recent analysis of the national consumption of fuel oil for domestic heating purposes the Oil Heating Institute reports that more and more coal dealers are putting in fuel oil storage tanks and catering to the growing demand for automatic heat. A canvass of 405 cities, made by the institute in the United States and Canada, found 522 such coal and oil dealers. Only 80 of these cities reported no such combinations.

The report shows that the consumption of fuel oil for domestic heating increased from 600,000 barrels in 1921 to 23,147,000 barrels in 1929, and it is estimated that 29,790,000 barrels will be burned in 1930. The number of domestic oil burners increased from 12,500 in 1921 to 535,000 in 1929, and it is estimated that on the 1st of next January there will be 655,000 in operation.

Alabama First-Aid Contest July 12

The twelfth annual first-aid contest of the Birmingham, Ala., district is scheduled to be held on July 12. The event is being sponsored by the State Department of Mines, U. S. Bureau of Mines, the Alabama Mining Institute, and Joseph A. Holmes Safety Chapters.

No Action Taken by Congress on Proposal to Exclude Russian Anthracite

No action will be taken by the House Committee on Ways and Means at this session of Congress on proposals to exclude Russian anthracite either by a prison labor provision or a tariff duty. Decision to this effect was reached by the committee following a hearing the middle of June on a bill of Representative Brumm of Pennsylvania to exclude this coal. The matter is expected to be again taken up at the next session in December.

As a basis for possible action later the committee has requested the Departments of State, Commerce, Treasury and Labor and the Tariff Commission to investigate and report on the importation of coal from Russia at the next session.

A late report to the Department of Commerce from Canada on imports of foreign anthracite says:

"There were heavy imports of Russian anthracite coal into St. John, New Brunswick, during the past year, one firm purchasing over 12,000 tons from a Montreal firm. The landing price was $8, the wholesale price $11.35, the price to the retailer $12.35, and the sale price to the consumer $15.50 cash. American anthracite sells for $14.50 cash. While American anthracite is still preferred, prominent coal merchants are exhibiting a noticeable tendency to turn to British and Russian coals.

"The first cargo this season of Russian anthracite arrived at Montreal from Mariupol early in May. It comprised 4,000 tons for Montreal, 2,500 tons for Fort Williams, and 1,800 tons for Brockville, Ontario. The consignments for Brockville and Fort Williams had to be lightered to Great Lakes vessels, a new departure in the distribution of Russian anthracite. Another cargo of coal was expected shortly at Three Rivers for that city, Montreal, and Brockville and another at Sorel, Quebec."

During the hearings before the Ways and Means Committee several members of the committee expressed their sympathy with the situation faced by the industry due to large imports of Russian coal, but expressed doubt whether relief would be afforded except through a specific tariff duty. The committee postponed action on the matter pending receipt of further information, including details of a contract alleged to have been made by Russian interests with an American company for the sale of the foreign coal at $1 per ton less than the American quoted price and at a commission of $1 per ton on all sales.

Representative Rainey, of Illinois, first raised the doubt as to whether the bill introduced by Mr. Brumm (H. R. 12061) to prohibit the importation of anthracite which may be mined by convict, conscripted, indentured or forced labor, saying that the Russian Soviet Government could certify that shipments were not mined by such labor, and further by the fact that most of the coal exported from Russia is mined by a Chinese company. Representative Estep, of Pennsylvania, a tariff duty on all imports of anthracite would be necesary to meet the situation, as this action would avoid diplomatic difficulties and uncertainties of customs administration.

The bill of Mr. Brumm, as amended after conference with Treasury officials, provides as follows:

"That from and after the enactment of this act anthracite coal mined, produced, or manufactured, wholly or in part by convict labor, conscripted labor, or indentured labor under penal sanctions, or by any other form of labor which is exacted from any person under menace of a penalty for its non-performance and for which the worker does not offer himself voluntarily, shall not be entitled to entry at any of the ports of the United States, and the importation thereof is hereby prohibited. The Secretary of the Treasury is authorized and directed to prescribe such regulations as may be necessary to carry out the provisions of this act."

The question of the efficacy of this prohibition was raised on the basis of the fact that all labor in Russia may be termed "forced" labor, as the people of Russia agree to work any place they are put. Statement was made that effort was made by the recent congressional conference committee to include a prohibition against Russian anthracite in the tariff law now being enacted, but that it had been barred by a parliamentary situation raised in the Senate. Under the new tariff law convict and other made goods other than by free labor are to be prohibited entry into the United States after January 1, 1932.

WITH THE MANUFACTURERS

New Simplified Automatic Switching Equipment for Motor Generators

New simplified automatic switching equipment, available for the control of the standard sizes of motor generators for mining service, is announced by the Westinghouse Electric and Manufacturing Company in a recent publication identified as Circular 1884.

This equipment is for the control of 100, 150, 200, and 300 kw., 2,300-volt a. c., three-phase, 25 or 60 cycles, 250-275-volt or 600-volt d. c. motor generator sets.

The high tension equipment, including the starting and running devices, current and potential transformers and their power interconnections, are mounted in a welded steel frame. This frame is completely inclosed with removable steel plates and, therefore, forms a cubicle. This cubicle provides protection for the employes against accidental contact with the high tension circuit, protects the switching devices against abnormal atmospheric conditions, as well as providing a very compact arrangement.

The automatic switching equipment provides for the starting and stopping of the unit by means of a remotely mounted push button, or a control switch mounted on the switchboard. The motor generator is connected to the auto transformer for reduced voltage starting, after the starting impulse has been given by the closing of the push button, or the control switch, and relays indicate correct starting conditions. When the unit reaches synchronous speed, the generator voltage is built up, and the synchronous motor field is excited, the motor is connected to the full line voltage. If the d. c. line conditions are normal, as indicated by the automatic reclosing equipment, the generator is automatically connected to the line.

New Sullivan Roller Sheaves

Engineers of the Sullivan Machinery Company have designed a new roller-bearing sheave or tail block for use in connection with scraper loading or slushing operations, in the interest of improving the character of slushing service rendered by Sullivan compressed air and electric portable hoists.

The success of underground scraper loading depends upon the freedom from delay with which the work is attended. Earlier designs of sheaves available on the open market have frequently failed to stand up to the severe service, causing delays by jamming or splintering of the wire rope, wearing out of the bearings, and undue binding and friction of the pulley against the side plates.

The Sullivan roller sheaves, built in 8, 10, and 12 in. diameters, are of unusually heavy, rugged construction. The sheave itself is made of manganese steel, and the side plates are electric steel castings. The swivel hook is made of drop-forged alloy steel. A swivel eyebolt may be substituted for the hook if desired. The Hyatt roller bearing supporting the sheave revolves on a hardened steel shaft of large diameter, which is hollow and serves as a reservoir for lubricant. The sheave is recessed into the side plates, thus preventing the possibility of jam-

A New Vulcan Locomotive

The Vulcan Iron Works, pioneers in the industrial locomotive field, have recently brought out a new line of gas-electric locomotives. The one illustrated herewith is a 12-ton narrow gauge locomotive for use in an asbestos mine quarry in Quebec.

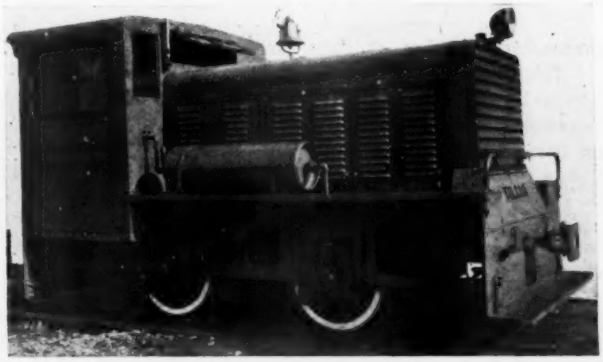
This 12-ton locomotive is powered with a 120-hp. Buda six-cylinder gasoline engine direct connected to a 250 volt d.c. shunt wound generator for furnishing electric energy to two Westinghouse mine haulage motors geared to the axles.

The locomotive is provided with a combination throttle and motor control. The controller has two handles, the speed handle controls the electro-magnetic switches, operates the engine throttle, regulates the generator field excitation, and the starting, accelerating and speed of locomotive. A separate reverser handle is provided for connecting the motors in "series" or "parallel" positions, and for "reverse" or "forward" directions. Movement of the speed handle from the "off" to the "pump" position speeds up the engine for operating the air compressor without running the locomotive.

It has the Vulcan standard cast steel bar type frames; steel-tired wheels 30 in. diameter; steel plate bumpers; cast steel single pocket coupler with spring draft gear; semi-elliptic springs cross equalized; four steel sand boxes equipped with air sanders; brakes applied through the Westinghouse air brake equipment and auxiliary hand lever; steel cab with double glass windows and an exhaust heater furnished special for use in cold climates. The locomotive is compactly built being only 13 ft. 6 in. long over the bumpers and 7 ft. wide, 8 ft. high.

Under dynamometer tests the locomotive developed a draw bar pull on a dry well sanded rail of 8,000 pounds at a speed of about 3 m.p.h. It has a maximum speed of between 18 to 20 m.p.h.

The gas-electric locomotive offers a number of particular advantages over other types in industrial service by reason of its unlimited mobility and availability, uninterrupted transmission of power to the loaded draw bar at all times; more rapid and steadier acceleration of the load; the automatic adjustment of speed to the load; wonderfully simple control; low maintenance and long life.



One of Vulcan Iron Works new gas-electric locomotives

ming as well as undue wear on the rope. Snatch-block construction has been employed in these sheaves, and the block may be readily opened by removing a pin. The opening for the rope at the top of the sheave will permit a square knot in the wire rope to pass through without binding.

Lubrication is by means of improved grease-gun fittings. These sheaves are rated at a maximum capacity of 6,000 lbs. for the 8-in. sheave, 10,000 for 10-in., and 140,000 for the 12-in. sheave.

A bulletin describing the Sullivan Roller Sheave, No. 76-K, will be sent on request to the manufacturer.

Automatic Time Switches

A new automatic time switch for closing and opening electric circuits at short predetermined intervals and on a uniform schedule, introduced by the General Electric Company, has a wide and varied application. Designated as Type TSA, it automatically energizes a circuit to control intermittent operation of electric equipment. The time cycle may be a few minutes or several hours, and is repeated continuously. Owing to the short time of a cycle, one complete "on" and "off" period—the operation is without regard to the time of day; in this respect the Type TSA time switches differ from the Types T-8 and T-9 automatic time switches which have 24-hour dials.

The time cycle depends upon the gearing used, and is fixed in each case at the factory. In certain forms, however, the relative amount of time "on" during the complete time cycle can be varied by the user.

The switches are single-pole, with one-way or two-way contacts, and are rated 5 amperes at 115 volts or 2½ amperes at 230 volts. On circuits of higher ampere rating a magnetic switch can be employed in conjunction with the time switch.

The contact-making device is driven by a Warren "Telechron" synchronous motor, thus insuring accurate and reliable timing when connected to an alternating current supply having the usual well regulated frequency. The device is housed in a sheet-metal, dust proof case for indoor mounting, with knockouts and a hinged front cover that is secured by a latch at the top, which may be sealed. A hanging lug is provided at the back for wall mounting.

Hercules Makes New Appointments

The appointment of H. V. Chase as assistant director of operations, explosives department, Hercules Powder Company, is announced by C. A. Bigelow, general manager of the department. For the past two years Mr. Chase has been superintendent of the Kenvil, N. J., explosives plant, and previous to this he was superintendent of the Bessemer, Ala., and Bacchus, Utah, plants of the company.

Succeeding Mr. Chase at Kenvil, W. S. Brimijoin has been appointed superintendent of the Kenvil plant. Formerly superintendent of the Joplin, Mo., and Bessemer, Ala., plants, Mr. Brimijoin has been assistant superintendent at Kenvil since 1928. The Kenvil plant is the largest in point of capacity of the explosives plants of the Hercules Powder Company.

Independent Pneumatic Tool Co. Expands

The Independent Pneumatic Tool Co., Chicago, manufacturers of Thor electric and pneumatic tools and air compressors, has purchased the Cochise Rock Drill Mfg. Co., of Los Angeles. This purchase is part of an expansion program inaugurated a year ago.

The Cochise Co. manufactures the well known line of Cochise rock drills and mining tools. The plant of the Cochise

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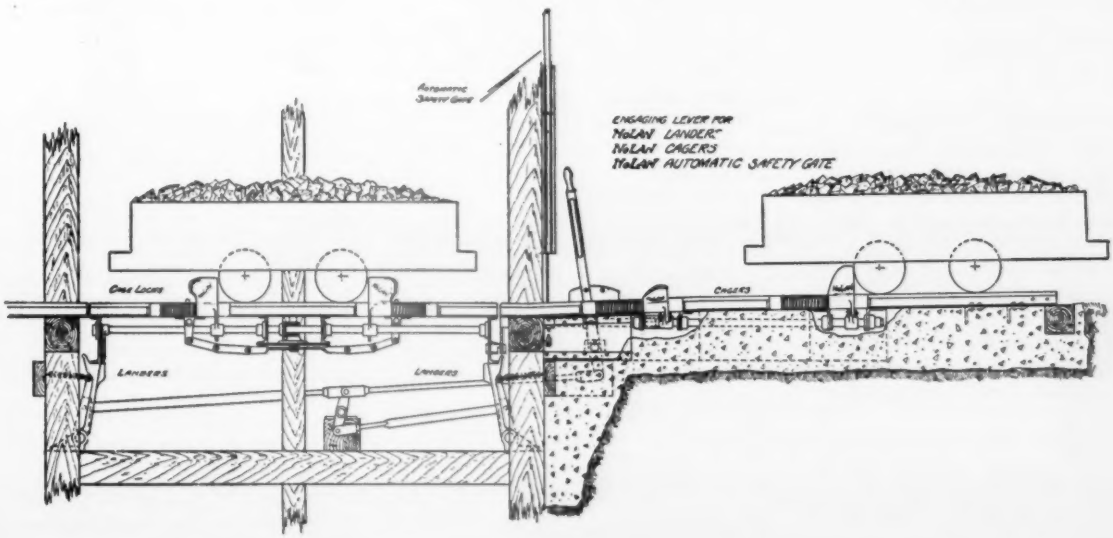
An Automatic Car Caging System for Intermediate Levels

A new mine car control caging system for intermediate levels has been developed in the past year by the Mining Safety Device Company, of Bowerston, Ohio. This unit was designed especially for anthracite mines where a number of intermediate levels exist and on which caging is sometimes done from different directions.

The unit consists of automatic cagers, automatic cage locks, automatic safety gates and manually controlled landing chairs. The landing chairs are controlled by a lever and interlocked with this lever is the operating member of the cagers. This operating member extends into the shaft compartment and contacts the bottom of the cage when the cage is to be landed at the level. The automatic safety gate is operated from the main shaft of the caging machine so that the gate is in operation only when cars are being caged.

The cage locks which comprise the means of automatically stopping and locking the cars on the cage are fully automatic. They are designed to receive a car from either side of the shaft. This feature is quite necessary in mines having more than one level, as the cars may be caged from the south on some levels and from the north on others.



Co. will be expanded, additional workmen will be employed and the products manufactured will be incorporated in the present line of the Independent Pneumatic Tool Co.

The Cochise Rock Drill Mfg. Co. will operate as a unit of the Independent Pneumatic Tool Co. There will be no change in personnel or methods.

The Independent Pneumatic Tool Co. was established 25 years ago and has grown rapidly. Last year a new and modern plant addition was built and today the factory covers an entire city block in Aurora, Ill.

Tighter Seal for Blasting Machines

An improvement on the Hercules Ten Cap blasting machine, which makes the machine more moisture and dust proof, is announced by officials of the explosives department, Hercules Powder Company. A special rubber gasket which seals case and cover has been developed as regular equipment and can be fitted to machines now in use.

The Hercules Ten Cap blasting machine is of the dynamo type, is pocket size, and represents the latest development in electrical machine design.

Air Travel Assumes New Guise in America

A recent announcement, made by the American Steel & Wire Company, a subsidiary of the United States Steel Corporation, indicates that America will soon have at hand a means of travel hitherto largely confined to Europe.

For the first time a really successful and efficient system of aerial tramways, for passenger transportation, will be made available. This was brought about by the appointment of the above company as sole licensees of the Bleichert and Bleichert-Zuegg Systems in America.

It becomes a simple matter, via the aerial route, to climb the highest mountain or cross the deepest river.

"Everything in Safety"

E. D. Bullard Company, manufacturers of safety equipment and material, announce the publication of their new catalog entitled "Everything in Safety," Catalog No. 30.

This catalog contains 144 pages and in addition to picturing and describing a most complete assortment of safety material and equipment for all industries, contains working information and data of interest and of value to all interested in safety work.

Distribution is now being made by the manufacturer and a copy of this new catalog will be sent upon application to any individual giving his name, address and business connection.

Link-Belt Patents Promal—A New Metal for Chains

A new line of cast chains showing remarkable strength and durability in comparison with malleable chains has been placed on the market by Link-Belt Company, Indianapolis. These chains are sold under the registered trade name of "PROMAL."

They are the result of extended research to provide longer life for drive and conveyor chains operating under heavy loads or abrasive conditions. Experimentation with cast chain metals, started about four years ago, led to the discovery of a new method of processing malleable iron which so altered its physical characteristics as to make it a distinctly new metal. This fact was recognized by giving it the distinctive name.

Compared with malleable iron, "Promal" has an average yield point of 45,000 lbs. as against 36,000 lbs.; an average ultimate strength of 65,000 lbs. as against 54,000 lbs.; an average elongation of 14 percent as against 18 percent; and a Brinell hardness of 170-190 as against 110-130. Compared with mild cast steel, annealed, "Promal" has an average yield point of 45,000 lbs. as against 34,000 lbs.; an average ultimate strength of 65,000 lbs. as against 60,000 lbs.; an average elongation of 14 percent as against 26 percent; and a Brinell hardness of 170-190 as against 120-140.

Although laboratory tests indicated the better wearing qualities of these new chains when they were first developed, they were withheld from the open market for over three years to permit extensive field tests. For these tests, many chains were tried out in various industries through the cooperation of Link-Belt customers. A check was then kept on performance while subjected to everyday usage. The results have uniformly sustantiated the laboratory tests.

For example, one "Promal" chain in a Pennsylvania cement mill, running night and day in an atmosphere saturated with cement dust, has already lasted more than twice as long as the malleable chain used before and shows no evidence of serious wear.

Robinson Ventilating Company

A description of the exhibit of the Robinson Ventilating Company at the recent Cincinnati Exposition of The American Mining Congress, which appeared in the May number of this magazine, incorrectly titled the portrait accompanying it as "L. R." instead of "J. R." Robinson. It was J. R. Robinson, president of the company, who attended the convention. "L. R.," the son of "J. R.," is sales manager.

New Magnetic Reversing Switch Handles Larger Motors

The ability to control motors of greater horsepower than those controlled by the superseded type is the principal advantage of a new enclosed, magnetic, reversing switch announced by the General Electric Company. This switch, designated CR-7009-B-18, supersedes the CR-7009-B-5 switch of the same type.

SULPHURIC ACID PLANT

(*From page* 615)

the atmosphere causing a niter loss. This condition is spoken of as "pale." If there is not enough SO_2 an excess of NO_2 will exist, and as it only partially reacts with cold sulphuric acid, a loss of niter is the result. This condition is called "rich." The reaction is:

$$H_2SO_4 + 2NO_2 = HSNO_5 + HNO_3$$

From the Gay-Lussac towers, the gases pass to the atmosphere. The nitrous vitriol is pumped to the top of the Glover tower, where it meets chamber acid, and the reactions start all over again.

Sodium Nitrate (Niter)

The sodium nitrate used comes from Chili. Synthetic nitrate of soda has also been used; that used was made by the Barrett Company, the trade name Arcadian nitrate of soda. It is made at Hopewell, Va. This niter is equally as good, if not better, than the Chilian niter. An average cost of the nitrate of soda used is $50 per ton. About 20 pounds is used per ton of 60-degree Baumé sulphuric acid produced.

Acid Circulating System and Coolers

The acid circulating system consists of blow cases for pumping the 60-degree Baumé acid, and air lifts for the chamber acid. The coolers, for cooling the hot acid from the Glover towers, are made from 1½-in. lead pipe in tanks. Water passes through the pipes and the hot acid around them.

Fans

Fans are used for the movement of the gases through the whole system. Two front fans between the first chamber and the Glover tower, one in operation and one in reserve. The back fan is between the last chamber and the Gay-Lussac towers.

Construction

The acid plant has 6 large chambers and 21 small ones, having a chamber space of 20 cu. ft. per pound of sulphur per day. The ratio of chamber space to radiation surface is 11 to 1; of chamber space to Glover tower packing, 125 to 1; of chamber space to Gay-Lussac tower packing, 35 to 1.

The towers are covered with lead, having brick walls and flat tile packing. Valves used for handling acid standard hard lead valves. Storage tank made of Alleghany iron, 5,000-ton capacity. Acid is shipped in standard steel tanks, 50-ton capacity.

Operation

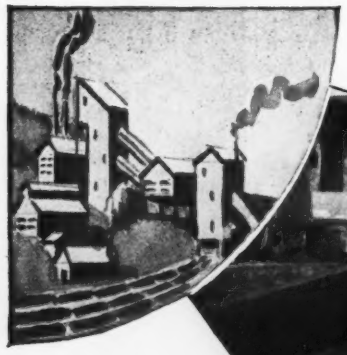
To successfully operate a chamber acid plant, one must know what the ideal attainable conditions are in each part of the plant and make such observations as are necessary to know that they are being closely approximated.

WIDELY ADAPTABLE

USE OF oxy-acetylene welding is not restricted to steel alone. Practically any commercial metal—steel, cast iron, virtually all ferrous and non-ferrous alloys and non-ferrous metals can be welded by this adaptable process.

Oxwelded joints are strong and tight—permanent and trouble-free. The wide adaptability of oxy-acetylene welding to all kinds of metals and most sorts of equipment makes this process indispensable to almost every industrial plant.

THE LINDE AIR PRODUCTS COMPANY, THE PREST-O-LITE COMPANY, INC., OXWELD ACETYLENE COMPANY, UNION CARBIDE SALES COMPANY,
Units of UNION CARBIDE AND CARBON CORPORATION
General Offices . . . . . New York UCC Sales Offices . . in the Principal Cities
65 Linde plants . . . 48 Prest-O-Lite plants . . . 174 Oxygen Warehouse stocks . . . 156 Acetylene Warehouse stocks . . . 42 Apparatus Warehouse stocks . . . 245 Union Carbide Warehouse stocks

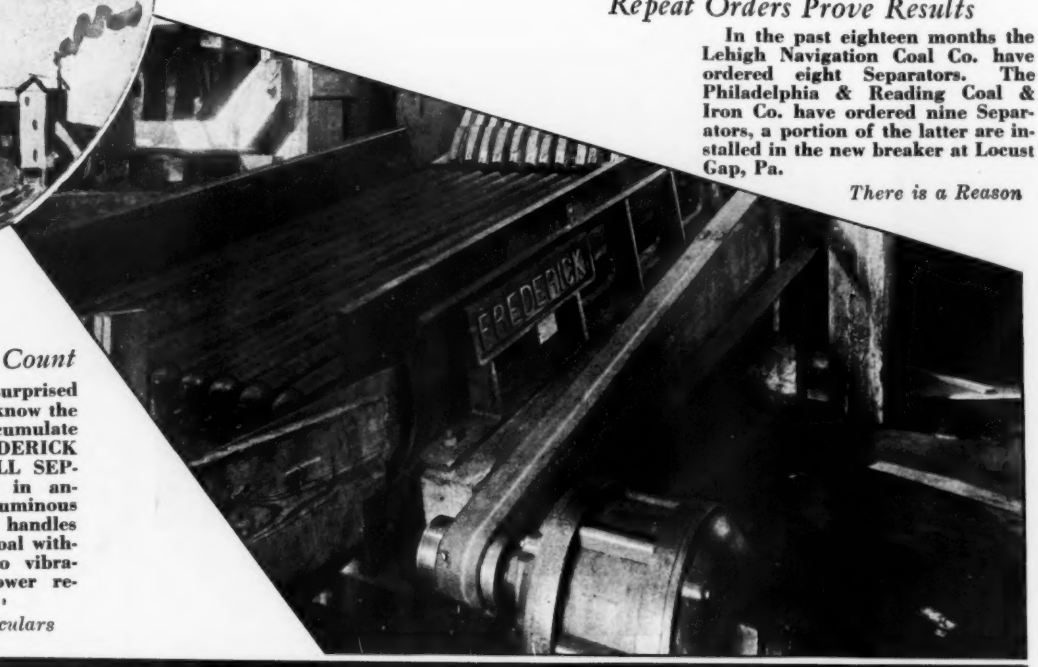


Here's a New Development *in* Screens

Repeat Orders Prove Results

In the past eighteen months the Lehigh Navigation Coal Co. have ordered eight Separators. The Philadelphia & Reading Coal & Iron Co. have ordered nine Separators, a portion of the latter are installed in the new breaker at Locust Gap, Pa.

There is a Reason



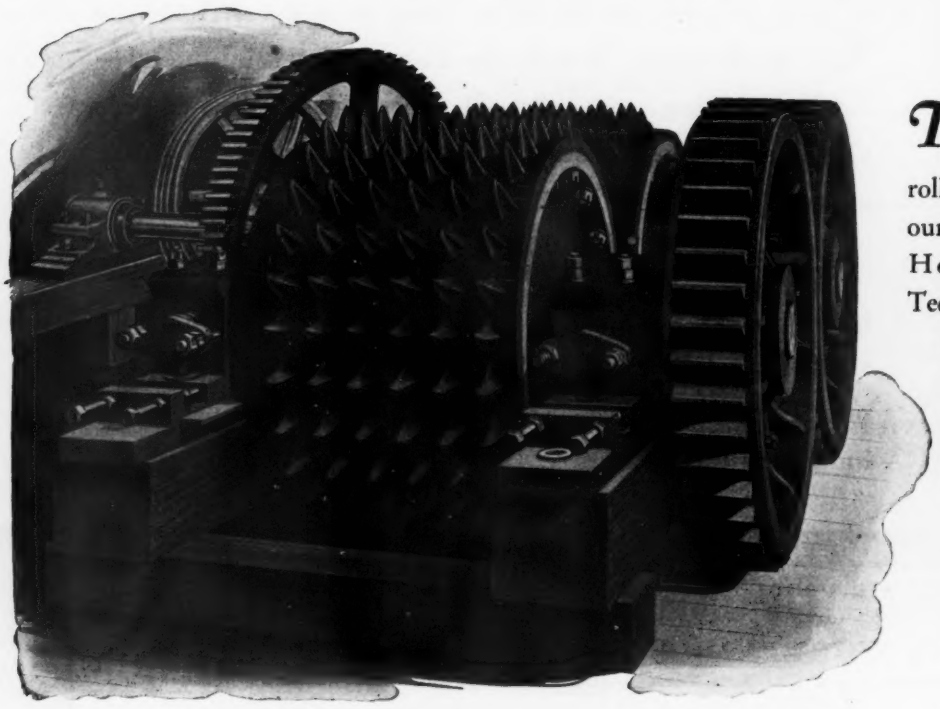
Profits Are What Count

You will be surprised and interested to know the savings that accumulate by the use of FREDERICK REVOLVING ROLL SEPARATOR. Used in anthracite and bituminous preparation as it handles the most friable coal without breakage. No vibration and less power required.

Write for Particulars

THE FREDERICK IRON AND STEEL CO.

FREDERICK - MD.



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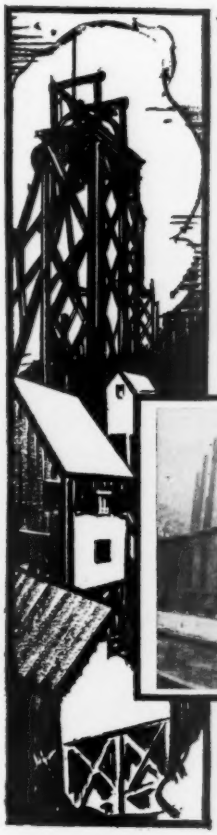

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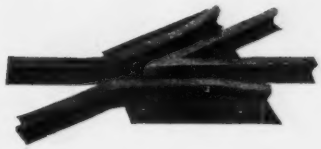

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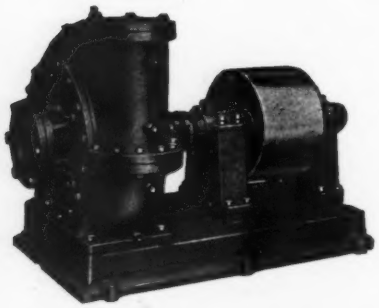

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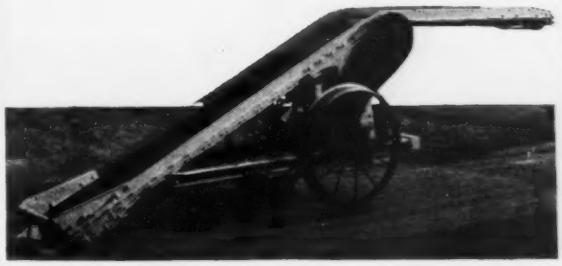

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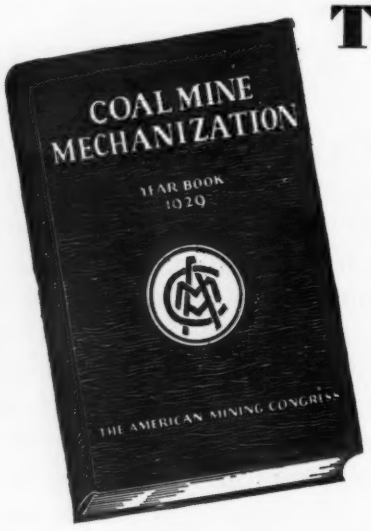
The new YEARBOOK on

COAL MINE MECHANIZATION



THE New Yearbook of Coal Mine Mechanization gives a complete picture of the progress of this important phase of coal mining. It discusses and describes mechanization, its developments, its economical phases, its progress in the several fields in the United States and foreign countries; it carries the actual reports of the mechanization survey conducted by The American Mining Congress; it carries a brief illustrated description, impartially presented, of the list of loading and conveying equipment offered by the American manufacturers. There are discussions by authorities on safety, power, ventilation, and room and pillar recovery.

Reports of the actual survey of The American Mining Congress include an outline of up to the minute developments in mechanical loading; descriptions of actual operations covering mechanical loading, conveyor mining and scraper mining; a study of the effect of mechanical loading on the several phases of mining. These reports are comprehensive, graphically illustrated by charts and diagrams and will be invaluable to everyone concerned with the important subject of mechanization of coal mining.

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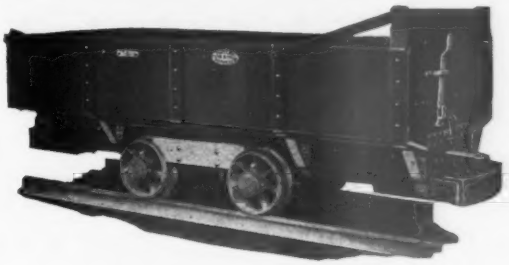

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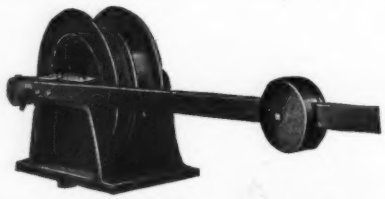

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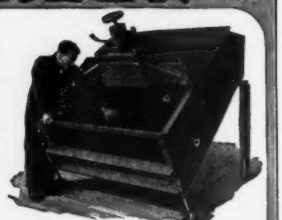

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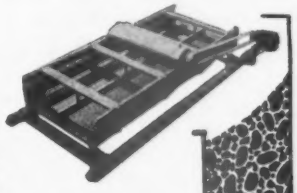

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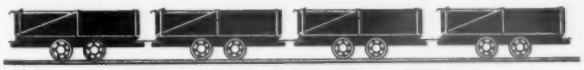

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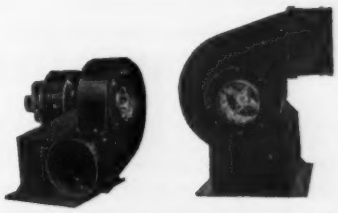

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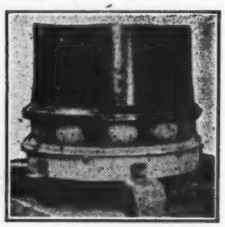

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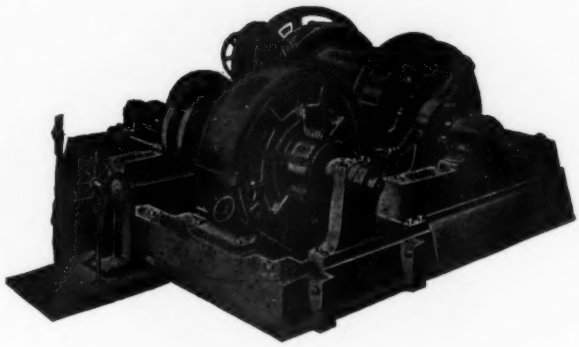

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SIMSBURY **CONNECTICUT**

Do Not "Short Fuse" --Fuse should be cut long enough for the end to extend well out of the mouth of the bore hole when the primer cartridge is in place. All holes should be well tamped.

If You Build or . .
Rebuild, Rearrange . .
Add Capacity
or Modernize
Your Plant

300-horsepower Morse Silent Chain Drive, installed in Western Coal Mine driving Ventilating Fan. Driver 575 R. P. M. Driven 130 R. P. M. 72" centers.

Phone MORSE *of course*

No matter how complicated your power transmission problems, trained Morse Power Transmission engineers can show you how to insure against production interruptions, conserve floor space, save power—show you the short cuts to efficient operation. They know how to design and install the drive best suited to your needs.

In many instances this service, with the installation of Morse Silent Chain Drives, Flexible Couplings or Speed Reducers, has speeded up operations, cut production costs and created savings far in excess of original expectations. We have reports on installations that have operated efficiently for 15 and 20 years, and on others that have saved thousands of dollars.

Morse Power Transmission Service is available in the principal centers of the country. A 'phone call, wire or letter will bring the Morse Engineer to your plant to consult with you entirely without obligation.

Write for free data file pertaining to your business.

MORSE CHAIN COMPANY
Ithaca, New York

MORSE SILENT CHAIN DRIVES